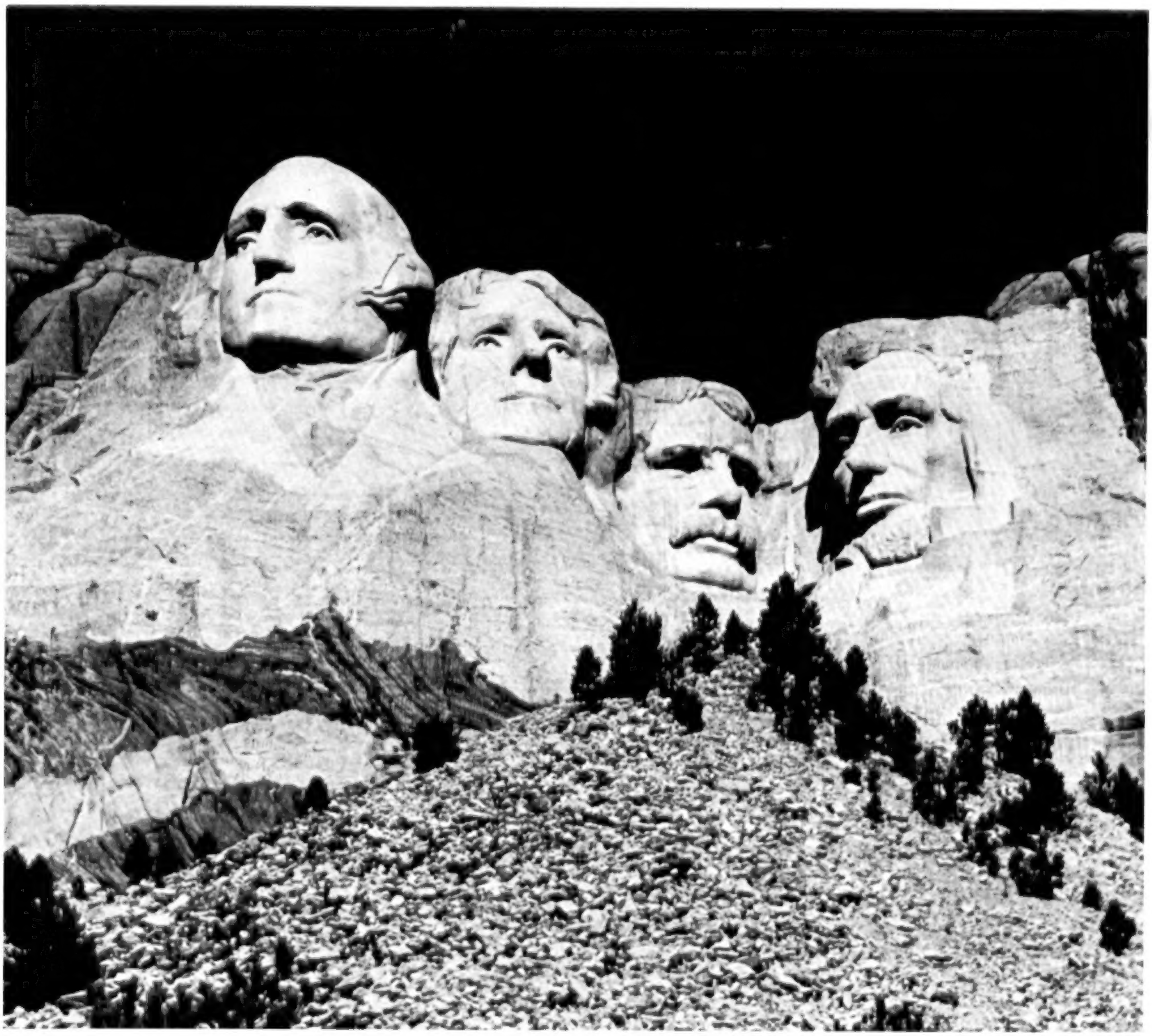
United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
United States Department
of Agriculture, Forest
Service, and South
Dakota Agricultural
Experiment Station

Soil Survey of Custer and Pennington Counties, Black Hills Parts, South Dakota



How To Use This Soil Survey

General Soil Map

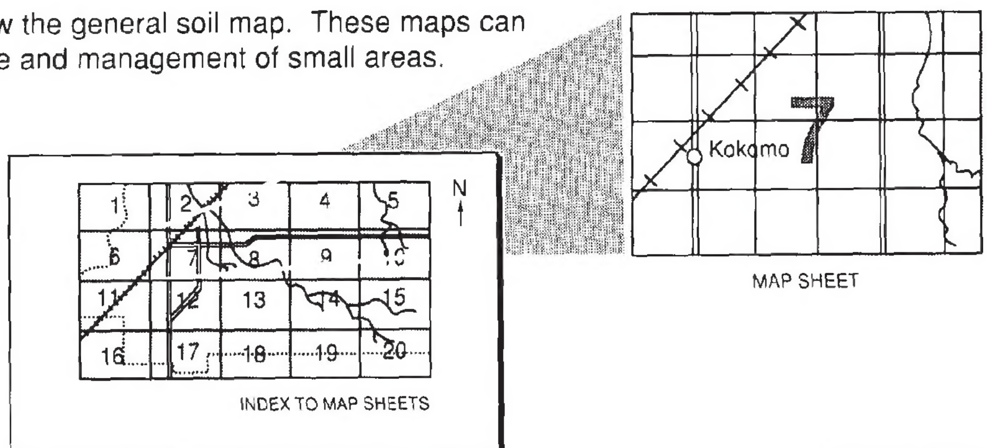
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

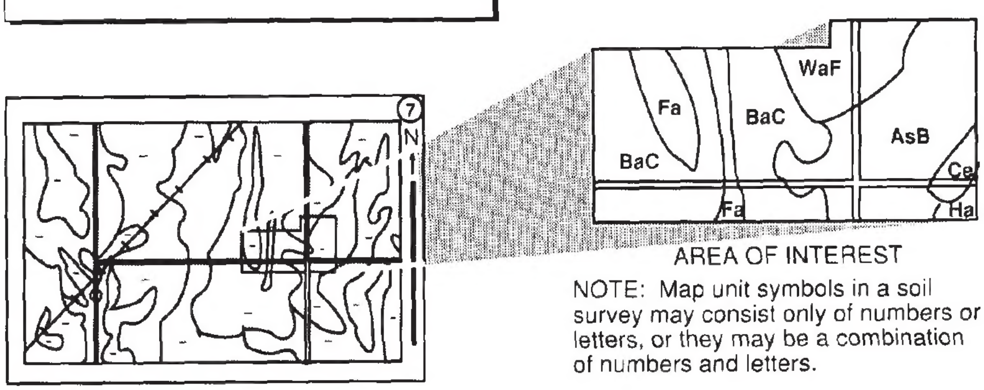
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



MAP SHEET

INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1984. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Black Hills National Forest, the Custer County Conservation District, and the Pennington County Conservation District. Some financial assistance was furnished by the South Dakota Department of Revenue, the Custer County commissioners, and the Pennington County commissioners.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Mount Rushmore National Memorial, which is in an area of Rock outcrop-Mocmont complex, 40 to 80 percent slopes.

Contents

Issued September 1990

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in the survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow over bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Billy W. Milliken
State Conservationist
Soil Conservation Service

Soil Survey of
Custer and Pennington Counties, Black Hills Parts, South Dakota

By Edgar H. Ensz, Soil Conservation Service

Soils surveyed by Scott Anderson, Kathleen A. Emerson, Edgar H. Ensz, Roland K. Krauss, and Arvid C. Meland, Soil Conservation Service, and Darwin D. Hoeft, Forest Service

United States Department of Agriculture, Soil Conservation Service and Forest Service, in cooperation with the South Dakota Agricultural Experiment Station

This survey area is in the southwestern part of South Dakota (fig. 1). It has a total land area of 1,167,040 acres, or about 1,823 square miles. Included in this area are Deerfield, Pactola, and Sheridan Reservoirs in Pennington County and Stockade Reservoir in Custer County. These reservoirs make up about 2,040 acres of water. About 743,600 acres in the survey area is federal land. The Forest Service administers about 709,000 acres, and the National Park Service administers the remaining 34,600 acres. About 75,200 acres is state land, which is administered by the Department of Game, Fish and Parks. About 346,200 acres is privately owned land.

According to the 1980 census, Custer, the county seat of Custer County, has a population of 1,830 *(13)*. Rapid City, the county seat of Pennington County, has a population of 46,492. Other towns and villages in the survey area are Dewey and Pringle in Custer County and Hayward, Hill City, Keystone, Rochford, and Silver City in Pennington County.

About 60 percent of the survey area is forested and managed for timber production. Other uses include livestock grazing, wildlife production, and recreation. About 10 percent of the acreage is state and federal parks. The remaining 30 percent is privately owned and is used mainly for livestock grazing and hay production. Only a minor amount of small grain is grown in the survey area.

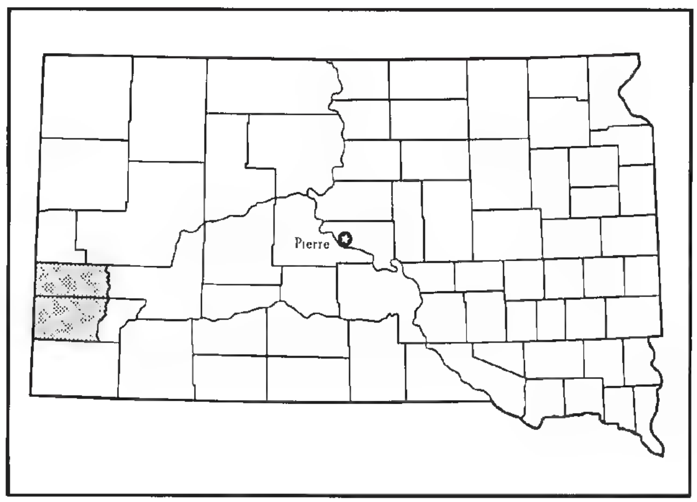


Figure 1.—Location of Custer and Pennington Counties, Black Hills parts, in South Dakota.

General Nature of the Survey Area

This section gives general information concerning the survey area. It describes climate; physiography, relief, and drainage; settlement; ranching, forestry, and farming; and natural resources.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

This survey area is usually warm in summer. Hot days frequently occur during the summer. In winter very cold periods occur when arctic air moves in from the north or northeast. The cold periods alternate with milder periods, which often occur when westerly winds are warmed as they move downslope. Most precipitation falls as rain during the warmer part of the year. The precipitation is normally heaviest in late spring and early summer. Snow falls frequently in winter, but the snow cover usually disappears during the mild periods.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Custer and Rapid City during the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperatures at Custer and Rapid City are 23 and 25 degrees, respectively. The average daily minimum temperature is 9 degrees at Custer and 13 degrees at Rapid City. The lowest temperature on record, which occurred at Custer on January 19, 1963, is -43 degrees. In summer the average temperature is 62 degrees at Custer and 70 degrees at Rapid City. The average daily maximum temperature is about 80 degrees. The highest recorded temperature, which occurred at Rapid City on July 6, 1973, is 110 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 18 inches at Custer and more than 16 inches at Rapid City. Of these totals, about 75 percent usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 4.03 inches at Custer on May 22, 1952. Thunderstorms occur on about 42 days each year. They may be accompanied by hail, which can cause severe crop damage.

Average seasonal snowfall is about 45 inches at Custer and about 39 inches at Rapid City. The greatest snow depth at any one time during the period of record was 28 inches at Custer and 17 inches at Rapid City. On the average, 23 days of the year at Custer and 37 days at Rapid City have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year. Blizzards with high winds and drifting snow may occur from late fall to early spring.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 70 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the north-northwest. Average windspeed is highest, 13 miles per hour, in spring.

Physiography, Relief, and Drainage

This survey area is within the Black Hills physiographic region. The Black Hills uplift is elliptical; it is approximately 125 miles long and 65 miles wide *(5)*. The survey area can be divided into four regions that have distinctive geologic and geomorphic features *(8)*. From the center of the uplift outward, these are: (a) the Central Crystalline Area, which includes a core of granite and metamorphic rock; (b) the Limestone Plateau, which encircles the Central Crystalline Area; (c) the Red Valley; and (d) the Dakota Hogback (fig. 2).

The Central Crystalline Area consists mostly of slate, schist, and granite. Relief is very pronounced. It is greatest where Harney Peak is about 2,000 feet higher than the area to the north. The Limestone Plateau is about 15 miles wide in the western part of Pennington County and 5 miles wide on the east side. Relief is relatively low, generally less than 200 feet. The Red Valley consists mainly of siltstone and shale. It is 0.5 mile wide near Rapid City and 5 miles wide southwest of Custer. Relief is generally less than 100 feet. The Dakota Hogback consists of interbedded sandstone and shale. It is a narrow ridge with local relief of about 500 feet.

The elevation in the survey area ranges from about 3,250 feet on the flood plain along Rapid Creek to 7,242 feet on Harney Peak. The larger streams that drain the area are Battle, Beaver, Boxelder, French, Pass, Pleasant Valley, Spring, and Rapid Creeks.

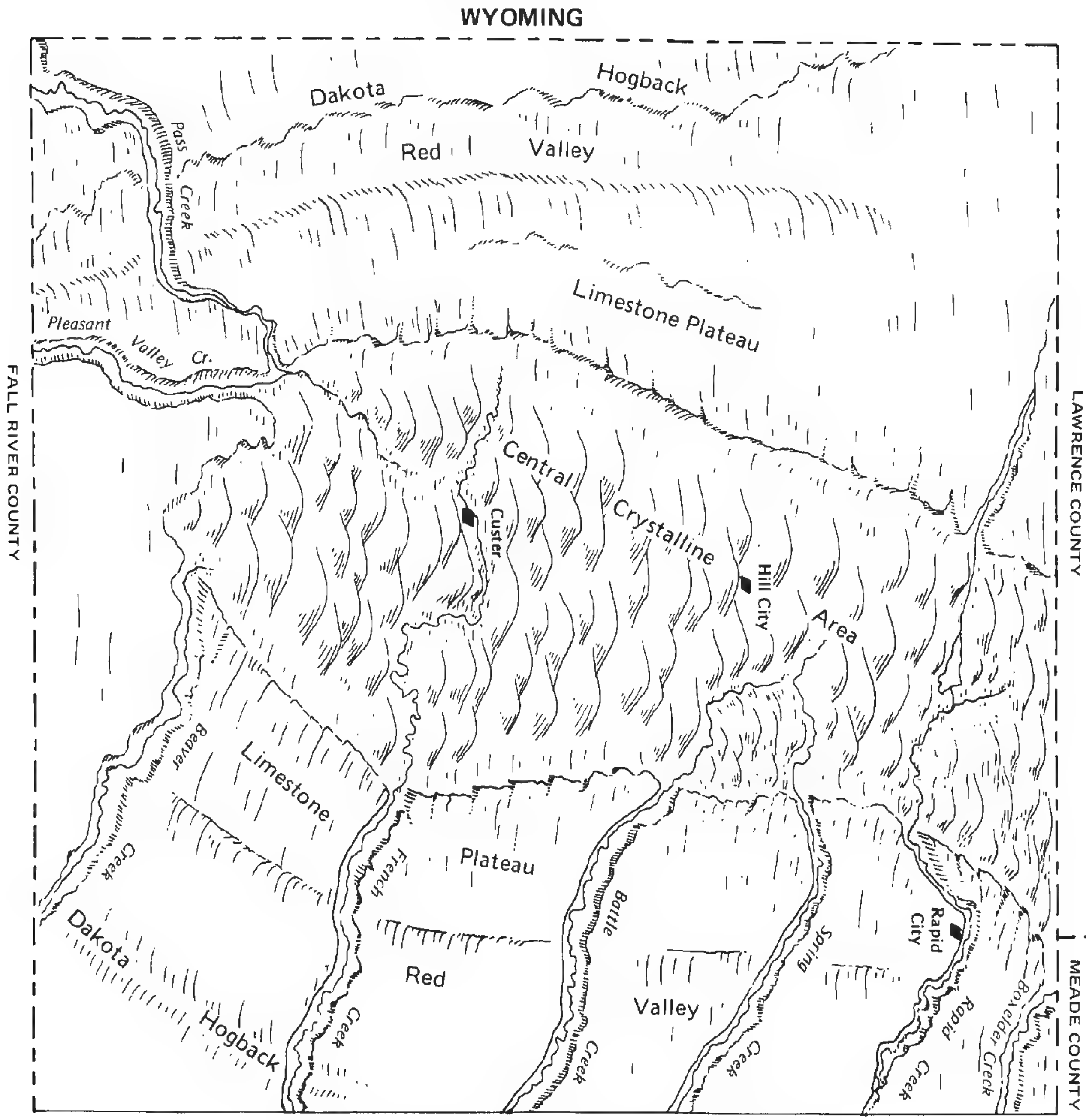


Figure 2.—The major physiographic features of the survey area.

These streams and numerous smaller streams drain into the Cheyenne River.

Settlement

During the expedition led by General George Custer to obtain information about the Black Hills, gold was discovered in French Creek on July 30, 1874. Word of this discovery spread rapidly. An estimated 10,000 people were drawn to the Black Hills between November 15, 1875, and March 1, 1876. From the settlement of Custer, the miners fanned out to explore the streams in the Harney Peak area. Favorable prospects in the gulches along Spring Creek led to the

establishment of a second mining camp at Hill City in February 1876 *(6)*.

Custer and Pennington Counties were officially organized in February 1877. Custer County included what are now Custer and Fall River Counties. Custer was platted late in 1875. It was the first town to be platted in the Black Hills area and the hub of early gold mining activities.

Pennington County is the only county of the three original counties set up in the Black Hills area to remain substantially unchanged since its inception. Rapid City, named the permanent county seat in 1877, was founded in February 1876. It became the eastern gateway to the mining region and an important station on the transportation routes from the south and east *(6)*. As richer gold deposits were discovered west and northwest of Rapid City, the population centers moved from the Custer area to the northern part of the Black Hills.

Ranching, Forestry, and Farming

Ranching is an important enterprise in the survey area. Many ranchers graze their cattle by permit in the Black Hills National Forest during the summer. Currently, 74,000 animal unit months of grazing are available within the survey area in an average year *(12)*.

Timber production is another important enterprise in Custer County. It supports many other industries. In recent years, the forest within the survey area has produced a sustained yield of around 50 million board feet annually.

Because of the nature of the Black Hills uplift in the survey area, farming enterprises are small and of minor economic importance. Steep slopes, rocky soils, and a short growing season prohibit farming in most areas. Some cultivated crops are grown, however, on some small tracts in the Red Valley, on isolated terraces at the lower elevations on the Limestone Plateau, and in mountain valleys throughout the survey area. These crops generally are small grain and tame hay.

The Custer County Conservation District and Pennington County Conservation District were organized in 1940. They have been instrumental in providing technical assistance to control erosion and improve water quality and quantity within the survey area *(7)*.

Natural Resources

Soil is the most important natural resource in the survey area. Timber, livestock, and crops are marketable products affected by the soil.

The water resources in the survey area generally are adequate for domestic and industrial uses and for livestock. The principal surface water resources are the Deerfield, Pactola, and Sheridan Reservoirs in Pennington County and the Stockade Reservoir in Custer County. Many small dams and the waters of Battle, Beaver, Boxelder, French, Pass, Pleasant Valley, Spring, and Rapid Creeks and of numerous smaller creeks provide livestock water in most years. Ground water from wells is available in most parts of the survey area. The depth to suitable aquifers varies greatly, however, because of the tilt of the geologic beds.

Mineral resources in the survey area include gold, limestone, silver, iron, uranium, feldspar, oil, and mica *(12)*. Currently, most of these are mined on a small scale. Limestone is mined on a fairly large scale for such products as portland cement, quicklime, and crushed rock for roads and concrete. Sand and gravel deposits are of limited extent.

The wildlife resources include primary game species, such as antelope, bighorn sheep, mule deer, white-tailed deer, elk, turkey, and mountain goat. A large herd of bison is managed in Custer State Park and a smaller herd in Wind Cave National Park. Other wildlife species, such as red fox, red squirrel, ruffed grouse, and golden eagle, are throughout the survey area. Brook, brown, and rainbow trout and other fish inhabit local streams and reservoirs.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of

landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit

descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The eight associations in the soil survey area have been grouped for broad interpretive purposes. The associations and groups are described on the pages that follow. Because of changes or refinements in some series concepts and differences in the design or extent of the associations, the names of the associations on the general soil map do not coincide exactly with those in the published surveys of adjacent areas. These areas include Lawrence and Meade Counties to the north and Fall River County to the south.

Soil Descriptions

1. Canyon-Rockoa-Rock Outcrop Association

Rock outcrop and shallow and deep, well drained, gently sloping to very steep, loamy soils formed in material weathered from interbedded limestone, sandstone, and shale; on uplands and mountains

This association is characterized by sharply dipped beds of sedimentary rock that form a fairly continuous ridge known as the Dakota Hogback. The major streams that flow out of the Black Hills have cut gaps through this association. Short, deeply entrenched drainageways have developed laterally from the major streams.

This association makes up about 7 percent of the survey area. It is about 25 percent Canyon soils, 20 percent Rockoa soils, 15 percent Rock outcrop, and 40 percent minor soils (fig. 3).

The shallow Canyon soils are generally on the warmer south- and west-facing slopes. Slopes range from 2 to 60 percent. Typically, the surface layer is brown, calcareous loam. The underlying material is very pale brown, calcareous gravelly loam with about 20 percent rock fragments by volume. Interbedded, soft, fine grained sandstone and hard, fractured limestone are at a depth of about 18 inches.

The deep Rockoa soils are generally on the cooler north- and east-facing slopes. Slopes range from 6 to 60 percent. Typically, the surface soil is dark grayish brown and light brownish gray cobbly fine sandy loam with about 30 percent rock fragments by volume. The subsoil is light brown, pinkish gray, and pink very cobbly clay loam with about 40 percent rock fragments by volume. The underlying material is pinkish white extremely cobbly fine sandy loam with about 65 percent rock fragments by volume.

The Rock outcrop is sandstone, limestone, or shale occurring as ledges on high parts of the landscape.

Minor in this association are the Butche, Lakoa, Satanta, and Zigweid soils. The shallow Butche soils are underlain by hard bedrock. They are on ridges. The deep Lakoa, Satanta, and Zigweid soils have fewer coarse fragments throughout than the Rockoa soils. They are on the less sloping parts of the landscape.

About 55 percent of this association is range. Maintaining the most productive grasses is a management concern. The slope is a limitation. Ponderosa pine is managed for timber production in the forested areas. Controlling water erosion and conserving moisture are concerns in managing woodland. The less sloping Rockoa soils are suited to woodland grazing where the tree canopy has been

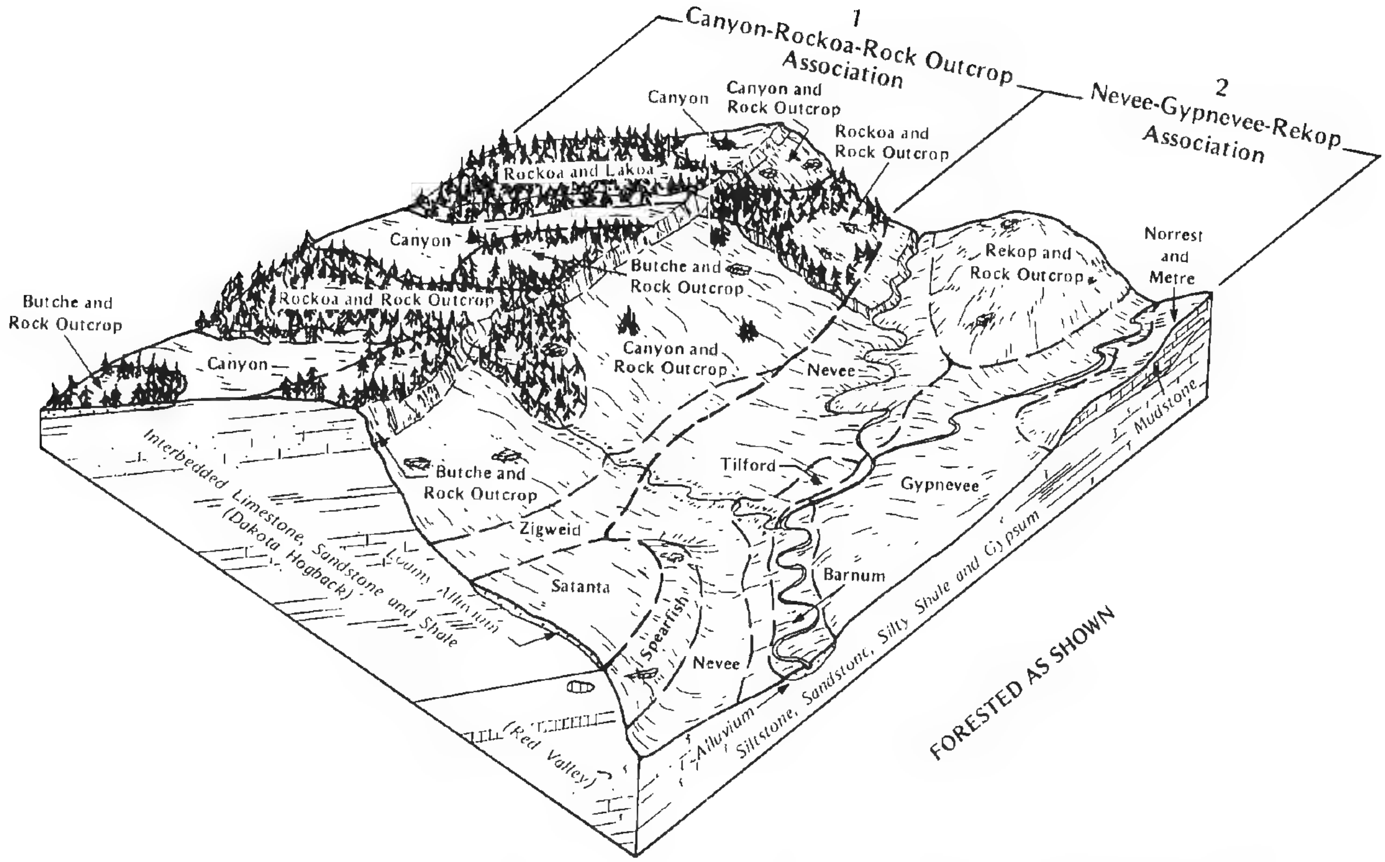


Figure 3.—Pattern of soils and parent material in the Canyon-Rockoa-Rock outcrop and Nevee-Gypnevee-Rekop associations.

opened. This association is suited to woodland wildlife habitat.

2. Nevee-Gypnevee-Rekop Association

Deep and shallow, well drained and somewhat excessively drained, gently sloping to very steep, silty and loamy soils formed in material weathered from siltstone, sandstone, silty shale, and gypsum; on uplands

This association is characterized by rounded knolls and shallow drainageways. The major streams that flow out of the Black Hills cross this association. Short, branched drainageways reach laterally from the major streams into the valley. This area is known locally as the Red Valley, which is less than 1 mile to several miles wide.

This association makes up about 10 percent of the survey area. It is about 20 percent Nevee soils, 15 percent Gypnevee soils, 10 percent Rekop soils, and 55 percent minor soils (fig. 3).

The deep, well drained Nevee soils are on the mid and low parts of the landscape. Slopes range from 2 to 30 percent. Typically, the surface soil is yellowish red, calcareous silt loam. The underlying material is reddish yellow and light red, calcareous silt loam and loam.

The deep, well drained Gypnevee soils are on the mid and low parts of the landscape. Slopes range from 6 to 20 percent. Typically, the surface layer is reddish brown, calcareous silt loam. The underlying material is light red and red, calcareous loam. Gypsiferous siltstone is at a depth of about 41 inches.

The shallow, well drained and somewhat excessively drained Rekop soils are on high parts of the landscape. Slopes range from 6 to 60 percent. Typically, the surface layer is reddish brown, calcareous loam. The underlying material is light reddish brown and pink, calcareous loam with about 50 percent gypsum by volume. White gypsum is at a depth of about 12 inches.

Minor in this association are the Barnum, Colombo,

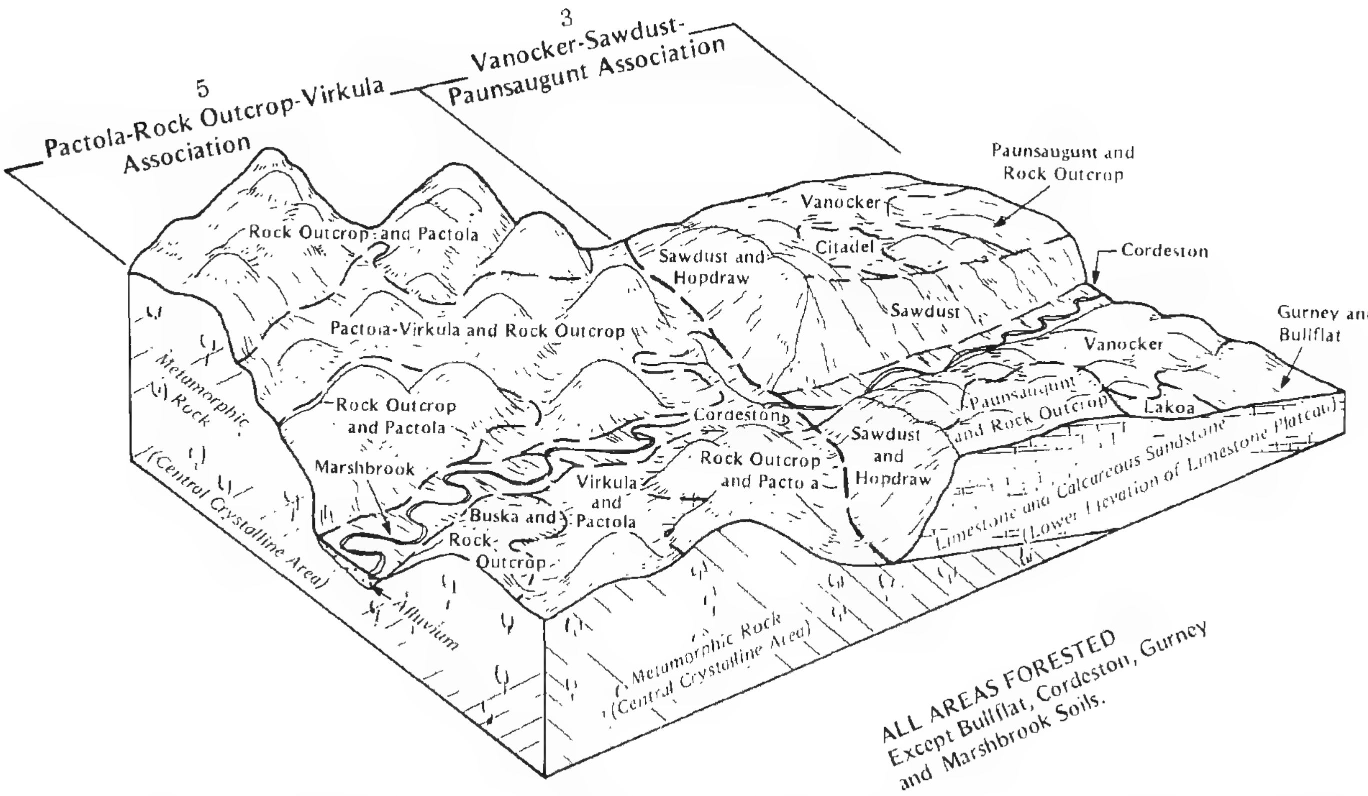


Figure 4.—Pattern of soils and parent material in the Vanocker-Sawdust-Paunsaugunt and Pactola-Rock outcrop-Virkula associations.

Fairburn, Metre, Nihill, Norrest, Spearfish, Tilford, and W netti soils and areas of Rock outcrop. The minor soils have less gypsum than the Gypnevee and Rekop soils. The deep Barnum, Colombo, and Winetti soils are on flood plains along the major creeks. The shallow Fairburn and moderately deep Metre and Norrest soils have more clay than the major soils. They are on old upland terraces in the southeastern part of the survey area. The deep Nihill soils are gravelly. They are on old upland terraces. The shallow Spearfish soils are in positions on the landscape similar to those of the Rekop soils. The deep Tilford soils are on the less sloping parts of the landscape. The Rock outcrop consists of red siltstone and white gypsum.

Nearly all of this association is range. A few areas are used for cultivated crops, tame pasture, or hay. Conserving moisture and controlling water erosion are management concerns. This association is well suited to range and rangeland wildlife habitat.

3. Vanocker-Sawdust-Paunsaugunt Association

Deep and shallow, well drained, gently sloping to very steep, loamy soils formed in material weathered from limestone and calcareous sandstone; on mountains

This association is characterized by broad ridges and canyons. It is highly dissected by drainageways and major streams. It is at the lower elevations on the Limestone Plateau. Some canyons are deeply entrenched and have very steep side slopes and rimrock ledges on high parts of the landscape.

This association makes up about 30 percent of the survey area. It is about 30 percent Vanocker soils, 25 percent Sawdust soils, 20 percent Paunsaugunt soils, and 25 percent minor soils (fig. 4).

The deep Vanocker soils are on the north- and east-facing slopes. Slopes range from 2 to 60 percent. Typically, the surface layer is brown channery loam. The subsoil is brown and pale brown very channery

clay loam with about 35 percent rock fragments by volume. It is calcareous in the lower part. The underlying material is very pale brown, calcareous very channery loam with about 40 percent rock fragments by volume.

The deep Sawdust soils are on the south- and west-facing slopes. Slopes range from 10 to 80 percent. Typically, the surface layer is dark grayish brown, calcareous channery loam with about 30 percent rock fragments by volume. The next layer is pale brown, calcareous very channery loam with about 50 percent rock fragments by volume. The underlying material is light yellowish brown, very pale brown, and yellow, calcareous extremely channery loam and extremely channery sandy loam with about 85 percent rock fragments by volume.

The shallow Paunsaugunt soils are on ridges. Slopes range from 2 to 40 percent. Typically, the surface layer is dark brown, calcareous gravelly loam with about 30 percent rock fragments by volume. The underlying material is brown, calcareous very gravelly loam with about 45 percent rock fragments by volume. Light brown limestone is at a depth of about 11 inches.

Minor in this association are the Bullflat, Citadel, Cordeston, Gurney, Hilger, Hopdraw, and Lakoa soils and areas of Rock outcrop. The deep Bullflat, Citadel, Cordeston, and Lakoa soils have fewer coarse fragments than the major soils. Bullflat, Citadel, Gurney, and Lakoa soils are on the less sloping parts of the landscape. Cordeston soils are along drainageways. The deep, sandy Hopdraw soils occur in scattered areas throughout the association. The deep Hilger soils formed in alluvium. They are on old terraces. Gurney soils have bedrock at a depth of about 28 inches. The Rock outcrop occurs as ledges and ridges of limestone and sandstone.

Nearly all of this association is managed for timber. A small acreage is range. The dominant species in the forested areas is ponderosa pine. Most of the association is used for livestock grazing, especially on slopes of less than 30 percent. Conserving moisture and controlling water erosion are management concerns. This association is suited to woodland grazing and woodland wildlife habitat. The Vanocker soils are suited to timber.

4. Stovho-Trebor Association

Deep and moderately deep, well drained, gently sloping to very steep, silty soils formed in material weathered from limestone and calcareous sandstone; on mountains

This association is characterized by very broad ridges, long, smooth side slopes, and wide valleys. It is dissected by a few major drainageways. It is at the higher elevations on the Limestone Plateau in the northwestern part of the survey area.

This association makes up about 13 percent of the survey area. It is about 50 percent Stovho soils, 35 percent Trebor soils, and 15 percent minor soils (fig. 5).

The deep Stovho soils are on the mid and low parts of the landscape. Slopes range from 2 to 40 percent. Typically, the surface layer is dark gray silt loam. The subsurface layer is light gray silt loam. The subsoil is yellowish brown and light yellowish brown silty clay and silty clay loam. It is calcareous in the lower part. The underlying material is yellow, calcareous channery silty clay loam with about 25 percent rock fragments by volume.

The moderately deep Trebor soils are on high parts of the landscape and on short, steep side slopes. Slopes range from 6 to 60 percent. Typically, the surface layer is grayish brown channery silt loam. The subsoil is dark brown and yellowish brown very channery and very flaggy silty clay loam with about 35 percent rock fragments by volume. The underlying material is light gray, calcareous very flaggy loam with about 50 percent rock fragments by volume. White limestone bedrock is at a depth of about 30 inches.

Minor in this association are the Lail, Heath, and Redbird soils and areas of Rock outcrop. The deep, reddish Lail soils are in landscape positions similar to those of the Stovho soils. The deep Heath and Redbird soils have less clay than the major soils. They are on low parts of the landscape. The Rock outcrop occurs as ledges and ridges of limestone and sandstone.

Nearly all of this association is managed for timber. A small acreage is range. The dominant species in the forested areas is ponderosa pine. Most of the acreage is used for livestock grazing. Minimizing the hazard of soil compaction caused by logging equipment and controlling water erosion on the moderately steep to very steep slopes are management concerns. This association is well suited to timber, woodland grazing, and woodland wildlife habitat.

5. Pactola-Rock Outcrop-Virkula Association

Rock outcrop and deep, well drained, gently sloping to very steep, loamy soils formed in material weathered from steeply tilted metamorphic rock; on mountains

This association is characterized by ridges, peaks, and canyons. It is highly dissected by drainageways and major streams, which are deeply entrenched. This entrenchment has resulted in long, steep side slopes.

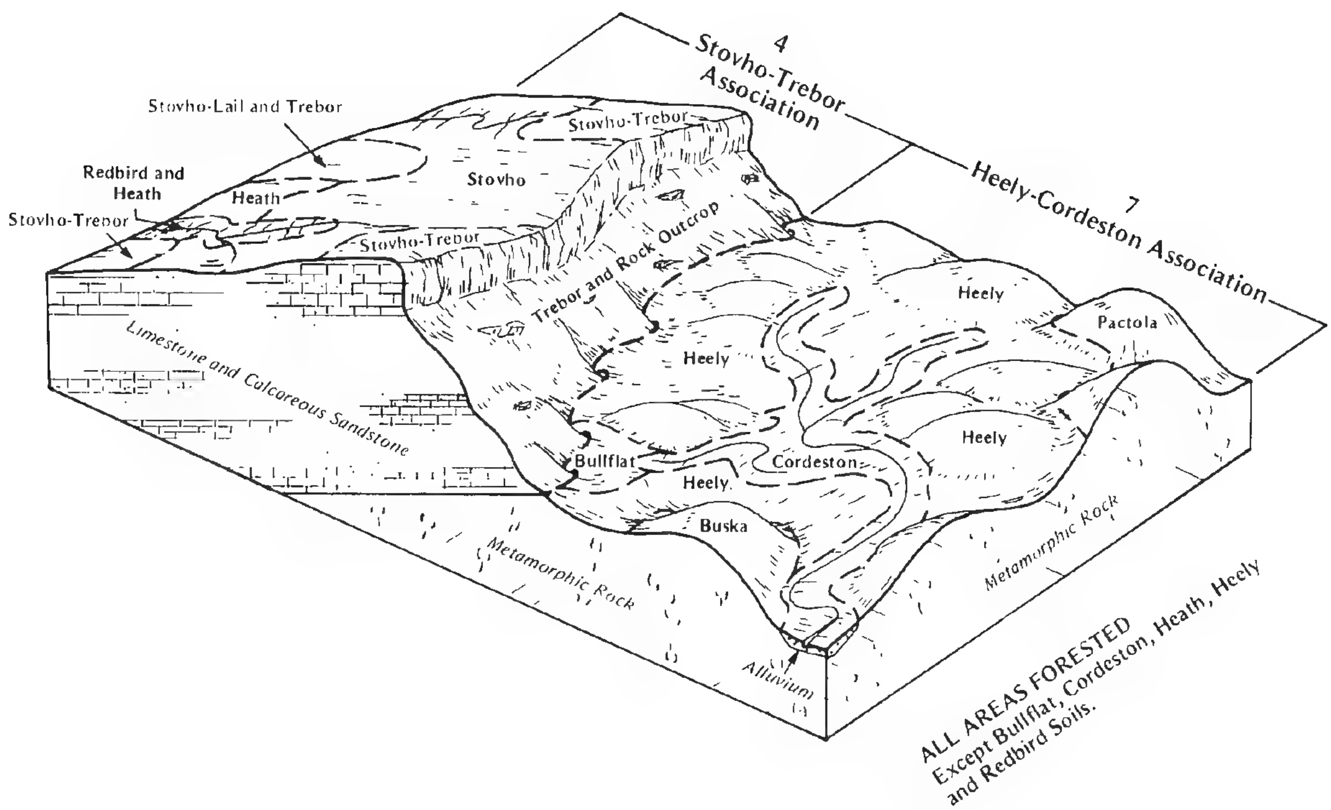


Figure 5.—Pattern of soils and parent material in the Stovho-Trebor and Heeley-Cordeston associations.

The association is in the northern half of the Central Crystalline Area.

This association makes up about 20 percent of the survey area. It is about 45 percent Pactola soils, 20 percent Rock outcrop, 15 percent Virkula soils, and 20 percent minor soils (fig. 4).

The Pactola soils are on the upper side slopes. Slopes range from 6 to 60 percent. Typically, the surface layer is dark gray channery loam with about 15 percent rock fragments by volume. The subsurface layer is very pale brown channery loam with about 30 percent rock fragments by volume. The subsoil is yellowish brown extremely channery clay loam with about 65 percent rock fragments by volume. Grayish brown, fractured metamorphic rock is at a depth of about 42 inches.

The Rock outcrop consists of peaks, ledges, and dikes of extremely hard, highly fractured, steeply tilted metamorphic rock.

The Virkula soils are on the slightly concave, mid and low side slopes. Slopes range from 2 to 35 percent. Typically, the surface layer is grayish brown loam. The subsurface layer is light gray loam. The subsoil is light yellowish brown silty clay loam. The underlying material is light yellowish brown channery and very channery silty clay loam.

Minor in this association are the Buska and Cordeston soils and the poorly drained Marshbrook soils. Buska soils formed in material weathered from micaceous schist. They are in landscape positions similar to those of the Pactola soils. Cordeston and Marshbrook soils formed in alluvium and are along drainageways.

Nearly all of this association is forested. A small acreage is used for range, tame pasture, hay, or small grain. Conserving moisture and controlling water erosion are management concerns. The association is well suited to timber on slopes of less than 40 percent and to woodland grazing on slopes of less than 25 percent. It is suited to woodland wildlife habitat.

6. Buska-Mocmont-Rock Outcrop Association

Rock outcrop and deep, well drained, gently sloping to very steep, loamy soils formed in material weathered from micaceous schist and granite; on mountains

This association is characterized by massive peaks, broad ridges, steep side slopes, and broad valleys. It includes the highest peak in the Black Hills. The association is in the Central Crystalline Area. It is highly dissected by small streams, which flow into the major streams.

This association makes up about 18 percent of the survey area. It is about 30 percent Buska soils, 20 percent Mocmont soils, 20 percent Rock outcrop, and 30 percent minor soils.

The Buska soils are on broad ridges and mountainsides. Slopes range from 2 to 50 percent. Typically, the surface layer is very dark gray loam. The subsurface layer is pale brown loam. The subsoil is yellowish brown very channery loam with about 40 percent rock fragments by volume. The underlying material s light yellowish brown very channery loam with about 45 percent rock fragments by volume. Fractured micaceous schist bedrock is at a depth of about 41 inches.

The Mocmont soils are on ridges and mountainsides. Slopes range from 2 to 60 percent. Typically, the surface layer is dark grayish brown gravelly loam with about 15 percent rock fragments by volume. The subsurface layer is very pale brown gravelly loam with about 20 percent rock fragments by volume. The subsoil is light yellowish brown very gravelly clay loam and extremely gravelly loam with 40 to 70 percent rock fragments by volume.

The Rock outcrop occurs as peaks and dikes of bedded, soft to very hard micaceous schist and extremely hard, massive granite. In some areas the micaceous schist is folded.

Minor in this association are the Cordeston, Pactola, Shirttail, and Virkula soils. The deep Cordeston soils formed in alluvium and are along drainageways. The deep Pactola soils are on the upper side slopes. They have fractured metamorphic bedrock at a depth of about 42 inches. The deep Shirttail soils have a surface layer that is darker than that of the major soils. They are in landscape positions similar to those of the major soils. The deep Virkula soils are in swales. They have fewer rock fragments than the major soils.

Nearly all of this association is forested. A small acreage is used for range, tame pasture, hay, or small grain. Conserving moisture and controlling water erosion are management concerns. The association is well suited to timber on slopes of less than 40 percent and to woodland grazing on slopes of less than 25 percent. It is suited to woodland wildlife habitat.

7. Heely-Cordeston Association

Moderately deep and deep, well drained, nearly level to steep, loamy soils formed in material weathered from steeply tilted metamorphic rock and in alluvium; on mountain prairies

This association is characterized by smooth, rolling hills. The drainage pattern is well defined. Drainageways range from shallow to deeply entrenched. Most of the association is in the northern half of the Central Crystalline Area.

This association makes up about 1 percent of the survey area. It is about 80 percent Heely soils, 15 percent Cordeston soils, and 5 percent minor soils (fig. 5).

The moderately deep Heely soils are in convex areas on the higher parts of the landscape. Slopes range from 6 to 30 percent. Typically, the surface layer is very dark grayish brown channery loam with about 30 percent rock fragments by volume. The subsoil is dark grayish brown and light olive brown very flaggy loam, very flaggy sandy loam, and extremely flaggy sandy loam with 40 to 60 percent rock fragments by volume. The underlying material is grayish brown extremely flaggy sandy loam with about 70 percent rock fragments by volume. Fractured metamorphic bedrock is at a depth of about 27 inches.

The deep Cordeston soils are on toe slopes and in swales. Slopes range from 0 to 10 percent. Typically, the surface layer is very dark gray loam. The subsoil is very dark gray and dark grayish brown loam. The underlying material is brown loam.

Minor in this association are the Bullflat, Buska, and Pactola soils and areas of Rock outcrop. The deep, silty Bullflat soils are in swales. The deep Buska and Pactola soils have more clay in the subsoil than the Heely soils. They are on mountain ridges and side slopes. The Rock outcrop occurs as low-relief dikes and ledges of slate, schist, and phyllite.

Nearly all of this association is range. A small acreage is used for forest, tame pasture, hay, or small grain. Conserving moisture and controlling water erosion are management concerns. The association is well suited to range. In some areas the Cordeston soils are fairly well suited to tame pasture and hay. They are poorly suited to small grain because of a short growing season. The association is suited to rangeland wildlife habitat.

8. Grummit-Arvada Association

Shallow and deep, well drained, nearly level to very steep, clayey and loamy soils formed in material weathered from acid shale and sedimentary rock; on uplands

This association is generally characterized by long, smooth slopes. A small area has short, steep and very steep slopes. The association is dissected by a few shallow, entrenched drainageways. It is in the southwest corner of the survey area.

This association makes up about 1 percent of the survey area. It is about 30 percent Grummit soils, 15 percent Arvada soils, and 55 percent minor soils.

The shallow Grummit soils are on high parts of the landscape. Slopes range from 2 to 60 percent. Typically, the surface layer is gray clay. The underlying material also is gray clay. Acid shale is at a depth of about 14 inches.

The deep Arvada soils are on low parts of the landscape. Slopes range from 0 to 6 percent. Typically, the surface layer is light gray fine sandy loam. The subsoil is brown and pale brown clay. In the lower part it is calcareous and has accumulations of salts. The underlying material is light brownish gray, calcareous clay that has accumulations of salts.

Minor in this association are the Demar, Haverson, Pierre, and Satanta soils and areas of Rock outcrop. The deep, moderately well drained Demar soils are in landscape positions similar to those of the Arvada soils. The deep Haverson soils formed in alluvium and are on low stream terraces. The moderately deep Pierre and deep Satanta soils do not have accumulations of salts. They are in landscape positions similar to those of the Arvada soils. The Rock outcrop is bare, gray, acid shale.

Nearly all of the acreage in this association is range. A small acreage is used for tame pasture and hay. Controlling water erosion and conserving moisture are management concerns. The association is well suited to range and rangeland wildlife habitat.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Tilford silt loam, 0 to 2 percent slopes, is a phase of the Tilford series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Pactola-Virkula-Rock outcrop complex, 10 to 40 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarries, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The Black Hills parts of Custer and Pennington Counties are separated from the prairie parts by an escarpment locally called the "Hayback," which circles the Black Hills. The soils inside the Hayback are generally unique to the Black Hills and differ greatly from the soils on the prairie. Two surveys have been completed in the Hayback area. The two surveys are separated by soil lines and have very few common areas. The names of some map units identified on the detailed soil maps of this survey area do not fully agree with those identified on the maps in the published surveys of Fall River, Lawrence, and Meade Counties, South Dakota, and Weston County, Wyoming. Differences are the result of variations in the design and composition of the map units or changes and refinements in series concepts.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

ApA—Arvada Variant loam, 0 to 2 percent slopes. This deep, poorly drained, rarely flooded, nearly level, sodium affected soil is on low terraces. It formed in

clayey and loamy alluvium. It is dissected by small meandering streams. Elevation ranges from 3,500 to 4,000 feet above sea level. Annual precipitation ranges from 14 to 16 inches. Areas are long and narrow and are 15 to 200 acres in size.

Typically, the surface layer is light brownish gray loam about 2 inches thick. The subsoil is about 16 inches thick. It is grayish brown, very firm clay in the upper part and light brownish gray, firm clay loam in the lower part. It has accumulations of salts in the lower part. The underlying material to a depth of about 60 inches is light brownish gray, light olive brown, and light yellowish brown, mottled, calcareous clay loam, silty clay loam, and loam. It has accumulations of salts. In some areas salts are at the surface.

Included with this soil in mapping are small areas of Haverson soils and Slickspots. These inclusions make up less than 15 percent of any one mapped area. Haverson soils have a lower content of clay and salts than the Arvada Variant soil. They are on low parts of the landscape. Slickspots support no vegetation and have a massive, clayey surface. They are in landscape positions similar to those of the Arvada Variant soil.

Fertility and the content of organic matter are low in the Arvada Variant soil. Tilth is poor. The sodium affected subsoil restricts the penetration of plant roots. The available water capacity is moderate. Permeability is very slow. The seasonal high water table is at a depth of 1 to 3 feet. The shrink-swell potential is high in the subsoil and moderate in the underlying material. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a hazard. Restricted grazing during wet periods helps to prevent compaction and the deterioration of tilth.

This soil generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. The high content of salts and the dense subsoil are the main limitations.

This soil is severely limited as a site for dwellings because of wetness and flooding. Dwellings should be built on the better drained adjacent soils.

This soil has severe limitations if used as a site for septic tank absorption fields. The wetness and the very slow permeability are the main limitations. Most waste disposal systems are a potential source of ground water pollution. Absorption fields should be located on the better drained, more permeable adjacent soils.

This soil has severe limitations if used as a site for hard-surfaced roads and streets. Low strength is the main limitation. Frost action is a hazard. Constructing the roads and streets on raised, well compacted, coarse grained subgrade or base material helps to prevent the damage caused by frost action and by low strength.

The land capability classification is VIIs-9, and the range site is Saline Lowland. The windbreak suitability group is 10.

AsA—Arvada-Slickspots complex, 0 to 3 percent slopes. This map unit occurs as areas of a deep, well drained, nearly level and very gently sloping, sodium affected Arvada soil closely intermingled with Slickspots. The unit is on uplands and terraces. The Arvada soil formed in clayey and loamy alluvium and colluvium. It is on slight rises. The Slickspots are in slight depressions. Elevation ranges from 3,500 to 4,000 feet above sea level. Annual precipitation ranges from 14 to 16 inches.

Areas of this map unit are irregular in shape and are 50 to 500 acres in size. They are 50 to 60 percent Arvada soil and 30 to 40 percent Slickspots. The Arvada soil and the Slickspots occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Arvada soil is light gray fine sandy loam about 3 inches thick. The subsoil is brown and pale brown, very firm and firm clay about 17 inches thick. In the lower part it is calcareous and has accumulations of salts. The underlying material to a depth of about 60 inches is light brownish gray, calcareous clay. In some areas depth to the seasonal high water table is 3 to 6 feet. In other areas the soil is strongly acid.

Slickspots have a light gray surface crust over dense, massive clay. They have salts at or near the surface. They support little or no vegetation.

Included in this unit in mapping are small areas of Haverson and Satanta soils. These soils make up less than 15 percent of any one mapped area. They have a lower content of clay and salts throughout than the Arvada soil. Haverson soils are on low parts of the landscape. Satanta soils are slightly higher on the landscape than the Arvada soil and the Slickspots.

Fertility and the content of organic matter are low in the Arvada soil. Tilth is poor. The sodium affected subsoil restricts the penetration of plant roots. The available water capacity is low, and permeability is very slow. The shrink-swell potential is high. Runoff is slow.

Most of the acreage of the Arvada soil supports native grasses and is used for grazing. Surface compaction is a hazard. Restricted grazing during wet periods helps to prevent compaction and the deterioration of tilth.

The Arvada soil generally is unsuited to cultivated

crops, to tame pasture and hay, and to windbreaks and environmental plantings. The high content of salts and the dense subsoil severely limit the growth of most plants. The Slickspots are an additional limitation.

The Arvada soil is severely limited as a site for dwellings because of the high shrink-swell potential. Backfilling with sandy material, installing foundation drains, and diverting runoff away from the buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Arvada soil is severely limited as a site for septic tank absorption fields because of the very slow permeability. Enlarging the absorption area helps to overcome the slow absorption of liquid waste. The soil has slight limitations if used as a site for sewage lagoons.

The Arvada soil has severe limitations if used as a site for hard-surfaced roads and streets. The high shrink-swell potential and low strength are the main limitations. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by shrinking and swelling. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

The land capability classification of the Arvada soil is VIs-3, the range site is Thin Claypan, and the windbreak suitability group is 10. The land capability classification of the Slickspots is VIIIs-3; no range site or windbreak suitability group is assigned.

BdA—Barnum very fine sandy loam, 0 to 3 percent slopes. This deep, well drained, rarely flooded, nearly level and very gently sloping soil is on terraces and flood plains in the Red Valley. It formed in calcareous, loamy alluvium weathered from reddish siltstone, sandstone, and silty shale. Elevation ranges from 3,200 to 5,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches. Areas are irregular in shape and are 5 to 100 acres in size.

Typically, the surface layer is yellowish red, calcareous very fine sandy loam about 2 inches thick. The subsurface layer is reddish yellow, very friable, calcareous loam about 3 inches thick. The underlying material to a depth of about 60 inches is reddish yellow, brown, and yellowish red, calcareous loam. In the upper part it is stratified with very thin layers of very fine sandy loam. In some areas the underlying material has thin layers of clay loam, silty clay loam, silt loam, or fine sandy loam. In other areas it has less clay and more sand.

Included with this soil in mapping are small areas of Gypnevee, Nevee, and Winetti soils. These soils make up less than 15 percent of any one mapped area. Gypnevee and Nevee soils are on high parts of the landscape. They are not stratified. Gypnevee soils have more gypsum than the Barnum soil. Winetti soils have rock fragments throughout. They are generally near stream channels.

Fertility is medium and the content of organic matter moderate in the Barnum soil. Tilth is good. The available water capacity is high. Permeability is moderate. The shrink-swell potential also is moderate. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth brome are suitable pasture plants. Oats and alfalfa are the main crops. Measures that conserve moisture, such as leaving crop residue on the surface and minimizing tillage, are the main management needs in cultivated areas.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

This soil is severely limited as a site for dwellings because of flooding. Dwellings should be built on the adjacent upland soils. If dwellings are constructed on this soil, installing dikes may protect the site from flooding.

This soil has moderate limitations if used as a site for septic tank absorption fields. The moderate permeability is the main limitation. Flooding is a hazard. Absorption fields should be located on the adjacent upland soils. Installing dikes may protect the site against flooding. Enlarging the absorption area helps to overcome the slow absorption of liquid waste.

This soil has moderate limitations if used as a site for hard-surfaced roads and streets. Low strength and the moderate shrink-swell potential are the main limitations. Flooding is a hazard. Installing drains and diverting floodwater away from roads help to prevent the damage caused by flooding and by shrinking and swelling. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

The land capability classification is IIIc-2, and the range site is Silty. The windbreak suitability group is 1.

BeB—Barnum-Winetti complex, 0 to 6 percent slopes. These deep, rarely flooded, nearly level to gently sloping soils are on flood plains and terraces along the major creeks. They are dissected by drainageways characterized by a few meanders. They are in the Red Valley and at the lower elevations on the Limestone Plateau. These soils formed in alluvium derived from reddish sandstone, silty shale, and other sedimentary rock. The well drained Barnum soil is in the higher landscape positions. The somewhat excessively drained Winetti soil is adjacent to channels on low parts of the landscape. Elevation ranges from 3,200 to 5,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are long and narrow and are 10 to 500 acres in size. They are 50 to 60 percent Barnum soil and 25 to 35 percent Winetti soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Barnum soil is yellowish red, calcareous very fine sandy loam about 2 inches thick. The subsurface layer is reddish yellow, very friable, calcareous loam about 3 inches thick. The underlying material to a depth of about 60 inches is reddish yellow, brown, and yellowish red, calcareous loam. In the upper part it is stratified with very thin layers of very fine sandy loam. In some areas the underlying material has thin layers of clay loam, silty clay loam, silt loam, or fine sandy loam. In other areas it is darker.

Typically, the surface layer of the Winetti soil is grayish brown, calcareous cobbly loam about 5 inches thick. The upper part of the underlying material is brown, calcareous loamy sand. The lower part to a depth of about 60 inches is grayish brown, calcareous gravelly and very cobbly sandy loam. In some areas the underlying material is redder.

Included with these soils in mapping are small areas of Gypnevee and Nevee soils on uplands. These included soils make up less than 15 percent of any one mapped area. They are not so stratified as the Barnum and Winetti soils.

Fertility is medium and the content of organic matter moderate in the Barnum and Winetti soils. Tilth is good in the Barnum soil and poor in the Winetti soil. The available water capacity is high in the Barnum soil and low in the Winetti soil. Permeability is moderate in the Barnum soil and moderately rapid in the Winetti soil. The shrink-swell potential is moderate in the Barnum soil and low in the Winetti soil. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used for grazing. Some areas at the higher elevations support thin stands of ponderosa pine. Some areas at the lower elevations support stands of hardwoods, such as green ash, cottonwood, and ironwood. Generally, no major hazards or limitations affect the use of these soils for range. Proper stocking rates and rotation grazing help to maintain maximum productivity.

The Barnum soil is poorly suited and the Winetti soil unsuited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth brome are suitable pasture plants in areas of the Barnum soil. Alfalfa and oats are the main crops. A high content of cobbles prevents tillage of the Winetti soil. Measures that control water erosion and conserve moisture, such as leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system, are needed in cultivated areas of the Barnum soil. The additional moisture provided by floodwater is beneficial in most years, and flood damage is minor.

The Barnum soil is well suited to windbreaks and environmental plantings, but the Winetti soil generally is unsuited because of the high content of cobbles. Most climatically suited trees and shrubs grow well on the Barnum soil.

These soils are severely limited as sites for dwellings because of flooding. Dwellings should be built on the adjacent upland soils. Installing dikes may protect the site against flooding.

These soils have moderate limitations if used as sites for septic tank absorption fields. The moderate permeability is the main limitation in the Barnum soil. Flooding is a hazard on both soils. Sanitary facilities should be located in the adjacent upland areas. If absorption fields are constructed on these soils, installing dikes may protect the site against flooding. Enlarging the absorption area helps to overcome the slow absorption of liquid waste.

These soils have moderate limitations if used as sites for hard-surfaced roads and streets. Low strength and the moderate shrink-swell potential are the main limitations in the Barnum soil. Frost action is a hazard in the Winetti soil. Flooding is a hazard on both soils. Constructing roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by shrinking and swelling, flooding, and frost action. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength.

The land capability classification is IVe-8 for the Barnum soil and VIs-4 for the Winetti soil. The range site of both soils is Overflow. The windbreak suitability group is 1 for the Barnum soil and 10 for the Winetti soil.

BrA—Bullflat silt loam, 0 to 3 percent slopes. This deep, well drained, nearly level and very gently sloping soil is on mountain prairies on the Limestone Plateau. It formed in silty alluvial and colluvial sediments weathered from sedimentary rock. Elevation ranges from 3,400 to 5,500 feet above sea level. Annual precipitation ranges from 17 to 20 inches. Areas are irregular in shape and are 5 to 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is brown, yellowish brown, and light yellowish brown, friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is very pale brown, calcareous gravelly and very cobbly clay loam. In some areas the subsoil has less sand and more silt. In other areas it has more clay or is redder. In places the depth to bedrock is 40 to 60 inches.

Included with this soil in mapping are small areas of Arvada, Gurney, and Hilger soils. These soils make up less than 15 percent of any one mapped area. Arvada and Hilger soils are in landscape positions similar to those of the Bullflat soil. Arvada soils have a sodium affected subsoil. Hilger soils have coarse fragments throughout. Gurney soils have bedrock at a depth of 20 to 40 inches. They are on high parts of the landscape.

Fertility and the content of organic matter are high in the Bullflat soil. Tilth is good. The available water capacity is moderate. Permeability also is moderate. The shrink-swell potential is moderate in the subsoil and low in the underlying material. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to cultivated crops and to tame pasture and hay. Intermediate wheatgrass, green needlegrass, and smooth brome are suitable pasture plants. Oats and alfalfa are the main crops. Measures that conserve moisture, such as leaving crop residue on the surface and minimizing tillage, are needed in cultivated areas.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

This soil has moderate limitations if used as a site for septic tank absorption fields or hard-surfaced roads and streets. Low strength and the moderate permeability are the main limitations. Frost action is a hazard. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Constructing the roads on raised, well compacted fill material helps to prevent the damage caused by frost action. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

The land capability classification is IVc-1, and the range site is Silty. The windbreak suitability group is 3.

BrB—Bullflat silt loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on mountain prairies on the Limestone Plateau. It formed in alluvial and colluvial sediments weathered from sedimentary rock. Elevation ranges from 3,400 to 5,500 feet above sea level. Annual precipitation ranges from 17 to 20 inches. Areas are irregular in shape and are 5 to 250 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is brown, yellowish brown, and light yellowish brown, friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is very pale brown, calcareous gravelly and very cobbly clay loam. In some areas the subsoil has less sand and more silt. In other areas it has more clay or does not have free carbonates. In places the depth to bedrock is 40 to 60 inches.

Included with this soil in mapping are small areas of Arvada, Gurney, and Hilger soils. These soils make up less than 15 percent of any one mapped area. Arvada and Hilger soils are in landscape positions similar to those of the Bullflat soil. Arvada soils have a sodium affected subsoil. Hilger soils have coarse fragments throughout. Gurney soils have bedrock at a depth of 20 to 40 inches. They are on high parts of the landscape.

Fertility and the content of organic matter are high in the Bullflat soil. Tilth is good. The available water capacity is moderate. Permeability also is moderate. The shrink-swell potential is moderate in the subsoil and low in the underlying material. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to

maintain maximum productivity.

Some areas are cultivated. This soil is suited to cultivated crops and to tame pasture and hay. Intermediate wheatgrass, green needlegrass, and smooth brome are suitable pasture plants. Oats and alfalfa are the main crops. Measures that conserve moisture and control erosion, such as leaving crop residue on the surface, farming on the contour, constructing grassed waterways, and minimizing tillage, are needed in cultivated areas. Returning crop residue to the soil and growing green manure crops reduce the hazard of erosion.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

This soil has moderate limitations if used as a site for septic tank absorption fields or hard-surfaced roads and streets. The moderate permeability and low strength are the main limitations. Frost action is a hazard. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Constructing roads on raised, well compacted fill material helps to prevent the damage caused by frost action. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

The land capability classification is IVe-1, and the range site is Silty. The windbreak suitability group is 3.

BsB—Bullflat-Cordeston silt loams, 2 to 9 percent slopes. These deep, well drained, gently sloping and moderately sloping soils are on mountain prairies and meadows dissected by very shallow, intermittent drainageways. They are in the Central Crystalline Area and at the lower elevations on the Limestone Plateau. The Bullflat soil formed in silty alluvial and colluvial sediments weathered from sedimentary rock. It is on side slopes. The rarely flooded Cordeston soil formed in loamy alluvium weathered from sedimentary or metamorphic rock. It is on the lower foot slopes and in swales. Elevations range from 4,600 to 6,200 feet above sea level. Annual precipitation ranges from 17 to 22 inches.

Areas of this map unit are long and fairly wide and are 5 to 300 acres in size. They are about 45 to 55 percent Bullflat soil and 30 to 40 percent Cordeston soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Bullflat soil is dark grayish brown silt loam about 6 inches thick. The subsoil is brown and yellowish brown, friable silty clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is pale brown, calcareous gravelly and very cobbly clay loam. In some areas the subsoil has more sand and less silt. In other areas it has more clay or does not have free carbonates. In places the depth to bedrock is 40 to 60 inches.

Typically, the surface layer of the Cordeston soil is very dark gray loam about 10 inches thick. The subsoil is very dark gray and dark grayish brown, very friable loam about 32 inches thick. The underlying material to a depth of about 60 inches is brown loam.

Included with these soils in mapping are small areas of Gurney, Hilger, and Marshbrook soils. These included soils make up less than 15 percent of any one mapped area. The moderately deep Gurney soils are in landscape positions similar to those of the Bullflat soil. Hilger soils are on small terraces. They have coarse fragments throughout. The poorly drained Marshbrook soils are in drainageways.

Fertility and the content of organic matter are high in the Bullflat and Cordeston soils. Tilth is good. The available water capacity is high. Permeability is moderate. The shrink-swell potential is moderate in the subsoil and low in the underlying material. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. Some areas of the Cordeston soil support ponderosa pine, bur oak, quaking aspen, and paper birch. No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

Many areas either have been or presently are cultivated. These soils are suited to cultivated crops and to tame pasture and hay. Measures that conserve moisture and control water erosion on the steeper slopes, such as returning crop residue to the soil and minimizing tillage, are needed in cultivated areas. Diverting runoff from the adjacent slopes helps to control erosion.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting the trees and shrubs on the contour helps to control erosion.

The Bullflat soil is slightly limited and the Cordeston soil severely limited as a site for dwellings. Flooding is

the main hazard on the Cordeston soil. Dikes protect the site against flooding.

These soils are moderately limited as sites for septic tank absorption fields because of the moderate permeability. Flooding is a hazard on the Cordeston soil. As a result, the absorption fields should be located on the Bullflat soil. Enlarging the absorption area helps to overcome the slow absorption of liquid waste.

These soils have moderate limitations if used as sites for hard-surfaced roads and streets. Low strength and the moderate shrink-swell potential are the main limitations. Flooding and frost action are hazards. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by flooding and by shrinking and swelling in areas of the Cordeston soil and by frost action in the Bullflat soil. Providing coarse grained subgrade or base material on the Bullflat soil helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity during wet periods.

The land capability classification is IVe-1. The range site of the Bullflat soil is Silty, and that of the Cordeston soil is Overflow. The windbreak suitability group is 3 for both soils.

BtE—Buska-Mocmont-Rock outcrop complex, 10 to 40 percent slopes. This map unit consists of deep, well drained, strongly sloping to steep Buska and Mocmont soils intermingled with areas of Rock outcrop. It is on mountains in the Central Crystalline Area. The Buska soil formed in loamy material weathered from micaceous schist. The Mocmont soil formed in colluvium and material weathered from granitic rock. The areas of Rock outcrop range to several acres in size and generally are on the mid or high parts of the landscape. Elevation ranges from 4,500 to 6,200 feet above sea level. Annual precipitation ranges from 17 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to several thousand acres in size. They are 35 to 45 percent Buska soil, 20 to 30 percent Mocmont soil, and 20 to 30 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Buska soil. The surface layer is very dark gray loam about 1 inch thick. The subsurface layer is pale brown loam about 11 inches thick. The next layer is brown and yellowish brown channery loam about 3 inches thick. The subsoil is yellowish brown, friable very channery loam about 10 inches thick. The underlying material is light yellowish brown very channery loam. Yellowish brown micaceous schist is at a depth of about 41 inches. In some areas the depth to bedrock is 20 to 40 inches. In other areas the subsoil has less mica.

Typically, about 1 inch of forest litter is on the surface of the Mocmont soil. The surface layer is dark grayish brown gravelly loam about 2 inches thick. The subsurface layer is very pale brown gravelly loam about 10 inches thick. The next 6 inches is light yellowish brown very gravelly clay loam and very pale brown very gravelly loam. The subsoil is light yellowish brown, friable and firm very gravelly clay loam about 32 inches thick. The underlying material to a depth of about 60 inches is light yellowish brown extremely gravelly loam. In some areas the subsoil is redder. In other areas the depth to bedrock is 30 to 60 inches.

The Rock outcrop is gray, hard granitic rock and gray, fractured schist. It occurs as massive domes and peaks in some areas and low, slabby protrusions in other areas.

Included in this unit in mapping are small areas of Cordeston and Virkula soils and soils that are less than 20 inches deep over bedrock. Included soils make up less than 15 percent of any one mapped area. Cordeston soils have a thick, dark surface layer. They are in meadows along drainageways. Virkula soils have fewer coarse fragments than the Buska and Mocmont soils. They are on concave side slopes, which generally are north aspects. The soils that are less than 20 inches deep over bedrock are generally adjacent to the Rock outcrop.

The available water capacity is low in the Buska and Mocmont soils. Permeability is moderate. The shrink-swell potential is low in the Buska soil and moderate in the Mocmont soil. Runoff is medium on both soils.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 70 on the Buska soil and 65 on the Mocmont soil. Some quaking aspen, paper birch, bur oak, and Black Hills spruce generally grow on north aspects and along drainageways. The understory is dominantly little bluestem, sedges, prairie dropseed, needlegrass, snowberry, leadplant, bearberry, and chokecherry.

Low strength, water erosion, and the hazard of windthrow are the main concerns in managing timbered areas. Some areas below the Rock outcrop have large boulders on the surface. These boulders interfere with felling and the use of skidding equipment and other equipment. Applying gravel to unsurfaced roads helps to overcome the low strength caused by the high

content of m ca in the Buska soil. Water erosion can be controlled by reseeding disturbed areas and by installing water bars and culverts. Mass soil movement may occur if the steep areas are disturbed. Harvesting or thinning methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard on the Buska soil.

This map unit is well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. Water erosion is a hazard along some cattle trails.

The Buska and Mocmont soils are severely limited as sites for dwellings, septic tank absorption fields, and hard-surfaced roads and streets because of the slope. The Rock outcrop and seepage are additional limitations. Better suited sites generally are available.

The land capability classification of the Buska and Mocmont soils is VIIe-9, and the grazable woodland group is Rocky Side Slopes. The land capability classification of the Rock outcrop is VIIIs-1; no grazable woodland group is assigned.

BuE—Buska-Rock outcrop complex, 10 to 40 percent slopes. This map unit consists of a deep, well drained, strongly sloping to steep Buska soil intermingled with areas of Rock outcrop. It is on mountain side slopes in the Central Crystalline Area. The Buska soil formed in loamy material weathered from micaceous schist. The areas of Rock outcrop generally are less than 1 acre in size. Elevation ranges from 4,500 to 6,200 feet above sea level. Annual precipitation ranges from 16 to 22 inches.

Areas of this map unit are irregular in shape and are 10 to several thousand acres in size. They are 55 to 65 percent Buska soil and 20 to 30 percent Rock outcrop. The Buska soil and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Buska soil. The surface layer is very dark gray loam about 1 inch thick. The subsurface layer is pale brown loam about 11 inches thick. The next layer is brown and yellowish brown channery loam about 3 inches thick. The subsoil is yellowish brown, friable very channery loam about 10 inches thick. The underlying material is light yellowish brown very channery loam. Yellowish brown micaceous schist is at a depth of about 41 inches. In some areas the bedrock is at a depth of 20 to 40 inches. In other areas the subsoil has less mica.

The Rock outcrop occurs as low-relief, fractured schist and dikes or plugs of quartzite or granite. Most of the schist outcrops have steeply tilted bedding planes.

Included in this unit in mapping are small areas of Cordeston, Mocmont, and Virkula soils and soils that are less than 20 inches deep over bedrock. Included soils make up less than 20 percent of any one mapped area. Cordeston soils have a thick, dark surface layer. They are along drainageways. Mocmont soils have less mica in the subsoil than the Buska soil. They are intermingled with areas of the Buska soil. Virkula soils have less mica, fewer coarse fragments, and more clay than the Buska soil. They are on concave side slopes. The soils that are less than 20 inches deep over bedrock are generally adjacent to the Rock outcrop.

The available water capacity is low in the Buska soil. Permeability is moderate. Runoff is medium.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 70 on the Buska soil. Some quaking aspen, paper birch, and Black Hills spruce generally grow on north aspects and along drainageways. The understory is dominantly little bluestem, sedges, prairie dropseed, snowberry, leadplant, chokecherry, and russet buffaloberry.

Low strength, erosion, and the hazard of windthrow are the main concerns in managing timbered areas. Some areas below the Rock outcrop have large boulders on the surface. These boulders interfere with felling and the use of skidding equipment and other equipment. Applying gravel to unsurfaced roads helps to overcome the low strength caused by the high content of mica in the Buska soil. Water erosion can be controlled by reseeding disturbed areas and by installing water bars and culverts. Mass soil movement may occur if the steep areas are disturbed. Harvesting or thinning methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard on the Buska soil.

The Buska soil is well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. Water erosion is a hazard along some cattle trails.

The Buska soil is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets because of the slope. The Rock outcrop and seepage are additional limitations. Better suited sites generally are available.

The land capability classification of the Buska soil is VIIe-9, and the grazable woodland group is Rocky Side Slopes. The land capability classification of the Rock

outcrop is VIIIs-1; no grazable woodland group is assigned.

BvC—Buska-Virkula loams, 2 to 15 percent slopes. These deep, well drained, gently sloping to strongly sloping soils are on broad ridgetops and smooth mountain side slopes in the Central Crystalline Area. The Buska soil formed in loamy material weathered from micaceous schist. It is on the upper side slopes and ridges. The Virkula soil formed in material weathered from metamorphic rock. It is on foot slopes and the lower side slopes. Elevation ranges from 4,800 to 6,000 feet above sea level. Annual precipitation ranges from 16 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to several thousand acres in size. They are 50 to 60 percent Buska soil and 25 to 35 percent Virkula soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Buska soil. The surface layer is very dark gray loam about 1 inch thick. The subsurface layer is pale brown loam about 11 inches thick. The next layer is brown and yellowish brown channery loam about 3 inches thick. The subsoil is yellowish brown, friable very channery loam about 10 inches thick. The underlying material is light yellowish brown very channery loam. Yellowish brown micaceous schist is at a depth of about 41 inches. In some areas the depth to bedrock is 20 to 40 inches. In other areas the subsoil has less mica.

Typically, about 1 inch of forest litter is on the surface of the Virkula soil. The surface layer is grayish brown loam about 1 inch thick. The subsurface layer is light gray loam about 12 inches thick. The next 9 inches is pale brown silty clay loam and light gray loam. The subsoil is light yellowish brown, firm silty clay loam about 23 inches thick. The underlying material to a depth of about 60 inches is light yellowish brown channery and very channery silty clay loam. In some areas the subsoil has more mica and less clay. In other areas it has a higher content of coarse fragments.

Included with these soils in mapping are small areas of Cordeston and Mocmont soils, soils that are less than 20 inches deep over bedrock, and areas of Rock outcrop. Inclusions make up less than 20 percent of any one mapped area. Cordeston soils have a thick, dark surface layer. They are along drainageways. Mocmont soils formed in material weathered from granite. They are in landscape positions similar to those of the Buska soil. The soils that are less than 20 inches deep over bedrock are generally adjacent to the Rock outcrop. The Rock outcrop is metamorphic or granitic rock that occurs as low-relief dikes or massive domes on high parts of the landscape.

The available water capacity is low in the Buska soil and high in the Virkula soil. Permeability is moderate in the Buska soil and moderately slow in the Virkula soil. The shrink-swell potential is low in the Buska soil and moderate in the Virkula soil. Runoff is medium on both soils.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 70 on the Buska soil and 72 on the Virkula soil. Some quaking aspen, Black Hills spruce, and paper birch grow in most areas. Bur oak grows on the Virkula soil in the eastern part of the survey area. The understory is dominantly little bluestem, sedges, prairie dropseed, western wheatgrass, needlegrass, snowberry, leadplant, chokecherry, and russet buffaloberry.

When the Virkula soil is wet, logging activities, such as skidding, hauling, and construction, can cause surface compaction and the formation of ruts. These activities should be restricted to periods when the soil is dry or frozen. Harvesting and thinning methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard on the Buska soil.

These soils are well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species.

These soils have moderate limitations if used as sites for dwellings. The moderate shrink-swell potential of the Virkula soil and the large stones and slope in areas of the Buska soil are the main limitations. Construction activities are hindered on the Buska soil because of numerous large stones. Buildings should be designed so that they conform to the natural slope of the land. Land shaping is needed in some areas. Backfilling with sandy material, installing foundation drains, and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling of the Virkula soil.

The Buska soil has moderate limitations and the Virkula soil severe limitations if used as a site for septic tank absorption fields. The slope and a thin layer of suitable material in areas of the Buska soil and the moderately slow permeability of the Virkula soil are the main limitations. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water. Land shaping and installing the distribution lines across the slope help to ensure that

the absorption fields function adequately in areas of the Buska soil. Enlarging the absorption area helps to overcome the slow absorption of liquid waste in areas of the Virkula soil.

The Buska soil has moderate limitations and the Virkula soil severe limitations if used as a site for hard-surfaced roads and streets. The slope and large stones in areas of the Buska soil and low strength in the Virkula soil are the main limitations. Frost action is a hazard on the Buska soil. Construction activities are hindered on the Buska soil because of numerous large rock fragments. Building roads and streets on the contour helps to overcome the slope. Providing coarse grained subgrade or base material, constructing adequate roadside ditches, and installing culverts minimize the damage caused by frost action and by low strength.

The land capability classification is VIe-13. The grazable woodland group is Rocky Side Slopes for the Buska soil and Silty Foot Slopes for the Virkula soil.

BwE—Butche-Rock outcrop complex, 9 to 60 percent slopes. This map unit consists of a shallow, excessively drained, strongly sloping to very steep Butche soil intermingled with areas of Rock outcrop. It is on mountains on the Dakota Hogback. The Butche soil formed in material weathered from sandstone. It is on side slopes and ridges. The areas of Rock outcrop generally are less than 3 acres in size and are scattered throughout the unit. Elevation ranges from 3,200 to 5,500 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 500 acres in size. They are 55 to 65 percent Butche soil and 20 to 30 percent Rock outcrop. The Butche soil and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Butche soil is dark grayish brown cobbly loam about 4 inches thick. The underlying material is pale brown, very friable cobbly loam. Very pale brown, hard sandstone is at a depth of about 10 inches. In some areas the bedrock is calcareous shale and weakly cemented sandstone. In other areas the soil has a higher content of sand.

The Rock outcrop is light gray, very pale brown, yellowish brown, or reddish brown, hard sandstone. It occurs as low-relief slabs of sandstone parallel to the surface in the less sloping areas and as ledges and high rimrock outcrops in the steeper areas.

Included in this unit in mapping are small areas of Gurney, Lakoa, and Rockoa soils. These soils make up less than 15 percent of any one mapped area. The moderately deep Gurney soils are in meadows. The deep Lakoa and Rockoa soils are intermingled with areas of the Butche soil, generally on the more densely forested parts of the landscape.

The available water capacity is very low in the Butche soil. Permeability is moderate. Runoff is medium or rapid.

Most of the acreage is used for timber. The overstory is dominantly stunted ponderosa pine. Because of the shallowness of the Butche soil and the Rock outcrop, the timber canopy generally is sparse and timber production is limited. The site index for ponderosa pine is about 35. The understory is dominantly little bluestem, sideoats grama, prairie sandreed, mountainmahogany, leadplant, and skunkbush sumac.

The slope, water erosion, and the hazard of windthrow are the main concerns in managing timbered areas. Building unsurfaced roads on the contour and in the less sloping areas helps to overcome the slope. Erosion can be controlled by seeding disturbed areas and by installing water bars and culverts. The windthrow hazard is severe on the Butche soil. It can be reduced by harvesting and thinning methods that do not isolate the remaining trees or leave them widely spaced.

The Butche soil is suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. The number of suitable sites for watering facilities is severely limited.

This map unit has severe limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets. The shallowness to bedrock in the Butche soil, the Rock outcrop, and the steep and very steep slopes are the main limitations. Seepage of liquid waste through cracks in the bedrock is a hazard in the Butche soil. Better suited sites generally are available. Unsurfaced roads may require additions of borrow material. Applying gravel to these roads improves the traffic-supporting capacity during wet periods.

The land capability classification of the Butche soil is VIIs-1, and the grazable woodland group is Shallow Ridge. The land capability classification of the Rock outcrop is VIIIs-1; no grazable woodland group is assigned.

CcE—Canyon-Bridget complex, 9 to 25 percent slopes. These well drained, strongly sloping and moderately steep soils are in the uplands on the Dakota

Hogback. They formed in loamy material weathered from interbedded sandstone and limestone. The shallow Canyon soil is on moderately steep side slopes and ridges. The deep Bridget soil is on the less sloping side slopes and foot slopes. Elevation ranges from 3,200 to 4,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 5 to 200 acres in size. They are 50 to 60 percent Canyon soil and 25 to 35 percent Bridget soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Canyon soil is brown, calcareous loam about 4 inches thick. Below this is a transitional layer of very pale brown, friable, calcareous gravelly loam about 6 inches thick. The underlying material is very pale brown, calcareous gravelly loam. Light gray, calcareous, soft, interbedded fine grained sandstone and fractured limestone are at a depth of about 18 inches. In some areas the soil is not calcareous. In other areas hard sandstone is at a depth of 7 to 20 inches.

Typically, the surface layer of the Bridget soil is grayish brown and brown, calcareous very fine sandy loam about 9 inches thick. Below this is a transitional layer of grayish brown, calcareous very fine sandy loam about 8 inches thick. The underlying material to a depth of about 60 inches is light brownish gray and light gray, calcareous very fine sandy loam. In some areas the soil has less sand and more silt. In other areas it has more clay.

Included with these soils in mapping are small areas of Gypnevee and Satanta soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. Gypnevee and Satanta soils are on low parts of the landscape. Gypnevee soils have a high content of gypsum throughout. Satanta soils have more clay in the subsoil than the Bridget soil. The Rock outcrop is on high parts of the landscape.

Fertility is low in the Canyon soil and medium in the Bridget soil. The content of organic matter is low in the Canyon soil and moderate in the Bridget soil. The available water capacity is very low in the Canyon soil and high in the Bridget soil. Permeability is moderate in both soils. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Proper stocking rates and rotation grazing help to maintain maximum productivity.

This map unit generally is unsuited to cultivated crops and to tame pasture and hay. The strongly sloping and moderately steep slopes and a shallow rooting depth in the Canyon soil are the main limitations.

The Bridget soil is suited to windbreaks and environmental plantings, but the Canyon soil generally is unsuited because of the shallowness to bedrock. All climatically suited trees and shrubs grow well on the Bridget soil, except for those that require an abundant supply of moisture. Planting the trees and shrubs on the contour helps to control erosion.

These soils have severe limitations if used as sites for dwellings, septic tank absorption fields, or hard-surfaced roads and streets because of the slope. Seepage of liquid waste through cracks in the bedrock is a hazard in the Canyon soil. Better suited sites generally are available. Applying borrow material to unsurfaced roads improves the traffic-supporting capacity of the Canyon soil.

The land capability classification of the Canyon soil is VIe-11, the range site is Shallow, and the windbreak suitability group is 10. The land capability classification of the Bridget soil is IVe-1, the range site is Silty, and the windbreak suitability group is 3.

CdF—Canyon-Rock outcrop complex, 15 to 60 percent slopes. This map unit consists of a shallow, well drained, moderately steep to very steep Canyon soil intermingled with areas of Rock outcrop. It is in the uplands on the Dakota Hogback. The Canyon soil formed in loamy, calcareous material weathered from interbedded sandstone and limestone. It is on side slopes. Scattered cobbles and stones are on the surface. The areas of Rock outcrop usually are less than 1 acre in size and generally are on ridges. Very large boulders which have broken from ledges near the crest of the ridges are scattered on the surface in some areas. Elevation ranges from 3,200 to 4,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 1,000 acres in size. They are 55 to 65 percent Canyon soil and 20 to 30 percent Rock outcrop. The Canyon soil and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Canyon soil is brown, calcareous loam about 4 inches thick. Below this is a transitional layer of very pale brown, friable, calcareous gravelly loam about 6 inches thick. The underlying material is very pale brown, calcareous gravelly loam. Light gray, calcareous, soft, interbedded

fine grained sandstone and fractured limestone are at a depth of about 18 inches. In some areas the soil is not calcareous. In other areas the depth to hard sandstone is 7 to 20 inches. In places the soil is sandy.

The Rock outcrop is calcareous, interbedded sandy shale, weakly cemented limestone, and sandstone. It is gray to brownish yellow.

Included in this unit in mapping are small areas of the deep Rockoa, Satanta, and Zigweid soils. These soils make up less than 15 percent of any one mapped area. Rockoa soils are generally on north-facing slopes. Satanta and Zigweid soils are on low parts of the landscape.

Fertility and the content of organic matter are low in the Canyon soil. The available water capacity is very low. Permeability is moderate. Runoff is medium or rapid.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. The slope in the steeper areas may restrict livestock grazing. Proper stocking rates and rotation grazing help to maintain maximum productivity.

This map unit is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. The slope and the shallow root zone of the Canyon soil are the main limitations.

This map unit has severe limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets because of the slope, the shallowness to bedrock, the unstable nature of the bedrock, and the Rock outcrop. Better suited sites generally are available. Applying borrow material to unsurfaced roads and trails improves the traffic-supporting capacity.

The land capability classification of the Canyon soil is VIIe-4, the range site is Shallow, and the windbreak suitability group is 10. The land capability classification is VIIIs-1 for the Rock outcrop; no range site or windbreak suitability group is assigned.

CkC—Citadel-Vanocker complex, 2 to 12 percent slopes. These deep, well drained, gently sloping to rolling soils are on broad ridgetops and smooth mountain side slopes at the lower elevations on the Limestone Plateau. They formed in material weathered from limestone and calcareous sandstone. The Citadel soil is on the lower side slopes. The Vanocker soil is on the higher side slopes. Elevation ranges from 3,500 to 6,200 feet above sea level. Annual precipitation ranges from 18 to 22 inches.

Areas of this map unit are irregular in shape and are 10 to 1,000 acres in size. They are 45 to 55 percent Citadel soil and 20 to 30 percent Vanocker soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Citadel soil. The surface layer is dark brown loam about 1 inch thick. The subsurface layer is light reddish brown loam about 9 inches thick. The next 4 inches is light reddish brown clay and reddish brown loam. The subsoil is about 28 inches thick. It is light reddish brown, firm clay in the upper part; brown, firm clay loam in the next part; and yellowish brown, friable, calcareous, gravelly clay loam in the lower part. The underlying material to a depth of about 60 inches is light yellowish brown, calcareous gravelly clay loam. In some areas the subsoil has less clay and more silt. In other areas the surface layer is thicker or darker.

Typically, about 1 inch of forest litter is on the surface of the Vanocker soil. The surface layer is brown channery loam about 2 inches thick. The subsoil is brown and pale brown, firm and friable very channery clay loam about 11 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is very pale brown, calcareous very channery loam. In some areas the depth to bedrock is 20 to 40 inches.

Included with these soils in mapping are small areas of Lakoa and Paunsaugunt soils and areas of Rock outcrop. Inclusions make up less than 20 percent of any one mapped area. The deep Lakoa soils have more sand and less clay than the Citadel soil and fewer rock fragments than the Vanocker soil. They are in landscape positions similar to those of the Citadel soil. The shallow Paunsaugunt soils are on high parts of the landscape. The Rock outcrop occurs as bare slabs that are parallel to the surface.

The available water capacity is high in the Citadel soil and moderate in the Vanocker soil. Permeability is slow in the Citadel soil and moderate in the Vanocker soil. The shrink-swell potential is high in the subsoil of the Citadel soil and moderate in the underlying material. It is moderate in the Vanocker soil. Runoff is medium on both soils.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 70 on the Citadel soil and 62 on the Vanocker soil. Some quaking aspen and paper birch grow on the Citadel soil. The understory is dominantly prairie dropseed, western wheatgrass, little bluestem, brome, common juniper, snowberry, and Oregongrape. When the Citadel soil is wet, logging

activities, such as skidding, hauling, and construction, can cause surface compaction and the formation of ruts. These activities should be restricted to periods when the soil is dry or frozen.

These soils are well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to maintain the desirable forage species. Many sites for watering facilities are available.

The Citadel soil is severely limited and the Vanocker soil moderately limited as a site for dwellings because of the shrink-swell potential. Backfilling with sandy material, installing foundation drains, and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Citadel soil is severely limited and the Vanocker soil moderately limited as a site for septic tank absorption fields because of the restricted permeability. Enlarging the absorption area helps to overcome the slow absorption of liquid waste.

The Citadel soil is severely limited and the Vanocker soil moderately limited as a site for hard-surfaced roads and streets. The shrink-swell potential of both soils and low strength in the Citadel soil are the main limitations. Frost action is a hazard. Constructing roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by shrinking and swelling and by frost action. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification is VIe-13. The grazable woodland group is Silty Foot Slopes for the Citadel soil and Cool Slopes for the Vanocker soil.

CoA—Colombo loam, channeled, 0 to 4 percent slopes. This deep, well drained, rarely flooded, nearly level and very gently sloping soil is on flood plains in the Red Valley and on the Dakota Hogback. It is dissected by streams characterized by many meanders. It formed in calcareous, loamy alluvium. Elevation ranges from 3,200 to 4,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches. Areas are long and narrow and are 10 to 200 acres in size.

Typically, the surface layer is brown and grayish brown, calcareous loam about 10 inches thick. The underlying material to a depth of about 60 inches is brown, calcareous loam and pale brown, calcareous sandy loam. In some areas the surface layer is not so dark or has less sand and more silt and clay. In other areas the underlying material has more sand.

Included with this soil in mapping are small areas of Tilford and Winetti soils. These soils make up less than 15 percent of any one mapped area. Tilford soils are redder than the Colombo soil. They are on high parts of the landscape. Winetti soils have rock fragments throughout. They are generally adjacent to stream channels.

Fertility is medium and the content of organic matter moderate in the Colombo soil. Tilth is good. The available water capacity is high. Permeability is moderate. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. Some areas along stream channels support bur oak, cottonwood, and green ash. Maintaining a good plant cover and ground mulch helps to control the streambank erosion caused by flooding during periods of rapid snowmelt and heavy thunderstorms.

This soil generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings because of the flooding and the small, isolated areas created by stream meanders. Hand planted trees and shrubs grow well.

This soil is severely limited as a site for dwellings because of the flooding. Better suited sites generally are available. If dwellings are constructed on this soil, installing dikes or enlarging the channel so that it can handle peak flows may protect the site against flooding. The sides of shallow excavations can cave in unless they are shored.

This soil has moderate limitations if used as a site for septic tank absorption fields or hard-surfaced roads and streets. The moderate permeability is the main limitation. Flooding and frost action are hazards. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Installing dikes helps to protect the site against flooding. Constructing roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by flooding and frost action.

The land capability classification is VIw-1, and the range site is Overflow. The windbreak suitability group is 3.

CpA—Colombo-Urban land complex, 0 to 2 percent slopes. This map unit consists of a deep, well drained, rarely flooded, nearly level Colombo soil and areas of Urban land in the Red Valley. It is on the flood

plain along Rapid Creek, below Canyon Lake. The Colombo soil formed in calcareous, loamy alluvium. Elevation ranges from 3,200 to 3,400 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Only one area of this unit was mapped. It is long and narrow and is approximately 800 acres in size. It is approximately 75 percent Colombo soil and 20 percent Urban land. The Columbo soil and Urban land occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Colombo soil is brown and grayish brown, calcareous loam about 10 inches thick. The underlying material to a depth of about 60 inches is brown, calcareous loam and pale brown, calcareous sandy loam. In some areas the surface layer is not so dark or has less sand and more silt and clay. In other areas the underlying material has more sand.

The Urban land is in areas that have been cut, buried, compacted, or disturbed in some way and now are covered with streets, buildings, or paved parking lots. The buildings are mostly commercial. Because the landscape has been altered and the soils covered with urban structures, identification of the soil series is not feasible.

Included in this unit in mapping are small areas of Tilford and Winetti soils. These soils make up less than 15 percent of the mapped area. Tilford soils are redder than the Colombo soil. They are on high parts of the landscape. Winetti soils have rock fragments throughout. They are generally adjacent to stream channels.

Fertility is medium and the content of organic matter moderate in the Colombo soil. The available water capacity is high. Permeability is moderate. Runoff is slow.

Most of the acreage is used for recreation areas, such as golf courses, parks, ball fields, and fishing sites. Some areas are used for flower gardens. The Colombo soil is well suited to grasses, flowers, trees, and shrubs. All climatically suited species grow well if the site is irrigated during dry periods.

This map unit has severe limitations if used as a site for dwellings and moderate limitations if used as a site for hard-surfaced roads and streets. Flooding and frost action are the main hazards. If dwellings are constructed on the Colombo soil, installing dikes may protect the site against flooding. The sides of shallow excavations can cave in unless they are shored. Constructing hard-surfaced roads and streets on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by flooding and frost action.

No interpretive groups are assigned to this unit.

CvB—Cordeston loam, 2 to 10 percent slopes. This deep, well drained, rarely flooded, gently sloping and moderately sloping soil is on flood plains in mountain meadows dissected by drainageways characterized by a few meanders. It is in the Central Crystalline Area. It formed in loamy alluvial material weathered from sedimentary and metamorphic rock. Elevation ranges from 4,000 to 6,200 feet above sea level. Annual precipitation ranges from 18 to 20 inches. Areas generally are long and narrow and are 10 to 200 acres in size.

Typically, the surface layer is very dark gray loam about 10 inches thick. The subsoil is very dark gray and dark grayish brown, very friable loam about 35 inches thick. The underlying material to a depth of about 60 inches is brown loam. In some areas the soil has coarse fragments throughout. In other areas it has more sand.

Included with this soil in mapping are small areas of Bullflat, Marshbrook, and Pactola soils and small areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. Bullflat soils are dark to a depth of less than 20 inches. They are on high parts of the landscape. Marshbrook soils have a seasonal high water table and are adjacent to stream channels. Pactola soils have more rock fragments throughout than the Cordeston soil. They are on mountain side slopes. The Rock outcrop is generally on the edge of the unit, adjacent to mountain side slopes.

Fertility and the content of organic matter are high in the Cordeston soil. Tilth is good. The available water capacity is high. Permeability is moderate. The shrink-swell potential is moderate in the subsoil and low in the underlying material. Runoff is slow or medium.

Most of the acreage supports native grasses and is used for grazing. Some areas support clusters of quaking aspen, paper birch, ponderosa pine, and bur oak. Streambank erosion is a management concern. Maintaining a good plant cover and ground mulch helps to control the erosion caused by flooding during periods of rapid snowmelt and heavy thunderstorms.

Some areas are used for tame pasture and hay. Big bluestem, indiangrass, orchardgrass, and tall fescue are suitable pasture plants. Controlling the encroachment of trees on the edges of the unit helps to maintain maximum productivity. The use of haying equipment is limited in some areas because of the Rock outcrop.

This unit generally is not cultivated because of a short growing season, the long and narrow shape of the

areas, and the Rock outcrop.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture.

This soil is severely limited as a site for dwellings because of the flooding. If dwellings are constructed on this soil, installing dikes may protect the site against flooding. Better suited sites generally are available.

This soil has moderate limitations if used as a site for septic tank absorption fields or hard-surfaced roads and streets. The moderate permeability and the shrink-swell potential are the main limitations. Flooding is a hazard. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Installing dikes may protect the site against flooding. Constructing roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by flooding and by shrinking and swelling. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

The land capability classification is IVe-1, and the range site is Overflow. The windbreak suitability group is 3.

CwB—Cordeston-Marshbrook loams, 0 to 6 percent slopes. These deep, nearly level and gently sloping soils are on flood plains of mountain meadows in the Central Crystalline Area (fig. 6). They generally are dissected by meandering perennial streams. They formed in loamy alluvium weathered from metamorphic rock. The well drained Cordeston soil is on the higher side slopes and foot slopes and is subject to rare flooding. The poorly drained Marshbrook soil is on the lower foot slopes and toe slopes and is occasionally flooded for brief periods. Elevation ranges from 4,800 to 6,200 feet above sea level. Annual precipitation ranges from 16 to 22 inches.

Areas of this map unit are long and narrow and are 10 to 400 acres in size. They are 50 to 60 percent Cordeston soil and 25 to 35 percent Marshbrook soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Cordeston soil is very dark gray loam about 10 inches thick. The subsoil is very dark gray and dark grayish brown, very friable loam about 35 inches thick. The underlying material to a depth of about 60 inches is brown loam. In some areas, the dark colors extend to a depth of less than 20 inches and the subsoil has more clay. In other areas the soil has coarse fragments throughout.

Typically, the surface layer of the Marshbrook soil is very dark grayish brown loam about 9 inches thick. The subsurface layer is dark grayish brown, mottled loam about 16 inches thick. The subsoil is grayish brown, mottled, friable loam about 16 inches thick. The underlying material to a depth of about 60 inches is dark grayish brown, mottled gravelly loam and dark gray, mottled gravelly sandy loam. In some areas the soil has coarse fragments throughout. In other areas it has a calcareous overburden. In places the seasonal high water table is at or near the surface.

Included with these soils in mapping are small areas of Buska and Pactola soils. These included soils make up less than 15 percent of any one mapped area. They are on high parts of the landscape. Buska soils have a higher content of mica and coarse fragments than the Cordeston and Marshbrook soils, and Pactola soils have a higher content of coarse fragments.

Fertility and the content of organic matter are high in the Cordeston and Marshbrook soils. The available water capacity also is high. Permeability is moderate in the Cordeston soil and moderately slow in the Marshbrook soil. In most years a seasonal high water table is at a depth of 1 to 2 feet in the Marshbrook soil. The shrink-swell potential is moderate in the subsoil of both soils and low in the underlying material. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. In some areas the Cordeston soil supports ponderosa pine and quaking aspen. Willow, Black Hills spruce, and paper birch grow in some areas of the Marshbrook soil. In other areas the vegetation is dominated by slough sedge and bulrushes. Generally, no major hazards or limitations affect the use of these soils for range. Proper stocking rates and rotation grazing help to maintain maximum productivity.

This map unit is suited to tame pasture and hay. Big bluestem, indiangrass, orchardgrass, and tall fescue grow well on the Cordeston soil. The Marshbrook soil is suited to water-tolerant plants, such as creeping foxtail and reed canarygrass.

In most areas these soils are poorly suited to cultivated crops because of a short growing season, the long and narrow shape of the areas, and the flooding.

These soils are suited to windbreaks and environmental plantings. All climatically adapted trees and shrubs grow well on the Cordeston soil, except for those that require an abundant supply of moisture. The trees and shrubs that require an abundant supply of moisture grow well on the Marshbrook soil.

These soils are severely limited as sites for dwellings

Figure 6.—A mountain valley meadow along Slate Creek in the Central Crystalline Area. Cordeston-Marshbrook loams, 0 to 6 percent slopes, are in the foreground. The forested side slopes are in an area of Rock outcrop-Pactola complex, 40 to 80 percent slopes.

because of the flooding. Better suited sites generally are available.

The Cordeston soil has moderate limitations and the Marshbrook soil severe limitations if used as a site for septic tank absorption fields. The restricted permeability and wetness are the main limitations. Flooding is a hazard. The absorption fields should be located on the better drained adjacent soils. Enlarging the absorption area helps to overcome the slow absorption of liquid waste in the Cordeston soil. Installing dikes helps to protect the site against flooding.

These soils have moderate limitations if used as sites for hard-surfaced roads and streets. The shrink-swell potential of the Cordeston soil is the main limitation. Flooding and frost action in areas of the Marshbrook soil are hazards. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by flooding, frost action, and shrinking and swelling. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Cordeston soil is IIIe-1, the range site is Overflow, and the windbreak suitability group is 3. The land capability classification of the Marshbrook soil is Vw-1, the range site is Subirrigated, and the windbreak suitability group is 2.

CxC—Cordeston-Winetti complex, 2 to 9 percent slopes. These deep, rarely flooded, gently sloping and moderately sloping soils are on flood plains of mountain meadows dissected by drainageways characterized by a few meanders. They are at the lower elevations on the Limestone Plateau. They formed in calcareous, loamy alluvium weathered from sedimentary rock. In some areas scattered stones and boulders are on the surface. The well drained Cordeston soil is on side slopes and the upper foot slopes. The somewhat excessively drained Winetti soil is adjacent to stream channels. Elevation ranges from 4,200 to 6,200 feet above sea level. Annual precipitation ranges from 17 to 20 inches.

Areas of this map unit are long and narrow and are 10 to 500 acres in size. They are 55 to 65 percent Cordeston soil and 15 to 25 percent Winetti soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Cordeston soil is very dark grayish brown, calcareous loam about 10 inches thick. The subsoil is very dark grayish brown and dark brown, very friable, calcareous loam about 22 inches thick. The underlying material to a depth of about 60 inches is grayish brown, calcareous loam. In some areas the lower part of the soil has a higher content of coarse fragments. In other areas the soil is noncalcareous to a depth of 20 inches.

Typically, the surface layer of the Winetti soil is grayish brown, calcareous cobbly loam about 5 inches thick. The upper part of the underlying material is brown, calcareous loamy sand. The lower part to a depth of about 60 inches is grayish brown, calcareous very gravelly and very cobbly sandy loam.

Included with these soils in mapping are small areas of Barnum and Bullflat soils. These included soils make up less than 15 percent of any one mapped area. Barnum soils are redder than the Cordeston soil. They are in landscape positions similar to those of the Cordeston soil. Bullflat soils are on high parts of the landscape. They are less stratified than the Cordeston soil.

Fertility is high in the Cordeston soil and medium in the Winetti soil. The content of organic matter is high in the Cordeston soil and moderate in the Winetti soil. The available water capacity is high in the Cordeston soil and low in the Winetti soil. Permeability is moderate in the Cordeston soil and moderately rapid in the Winetti soil. The shrink-swell potential is moderate in the subsoil of the Cordeston soil and low in the underlying material. It is low in the Winetti soil. Runoff is slow or medium on both soils.

Most of the acreage supports native grasses and is used for grazing. The Winetti soil supports some clusters of ponderosa pine, quaking aspen, paper birch, and bur oak. Generally, no major hazards or limitations affect the use of these soils for range. Proper stocking rates and rotation grazing help to maintain maximum production.

This map unit is poorly suited to cultivated crops and to tame pasture and hay because of the flooding, the long and narrow shape of the areas, and the cobbles in the Winetti soil.

The Cordeston soil is suited to windbreaks and environmental plantings, but the Winetti soil is unsuited because of the cobbles. All climatically suited trees and shrubs grow well on the Cordeston soil, except for those that require an abundant supply of moisture.

These soils are severely limited as sites for dwellings because of the flooding. Dwellings should be built on the adjacent upland soils. If dwellings are constructed on this unit, installing dikes may protect the site against flooding. The sides of shallow excavations in areas of the Winetti soil can cave in unless they are shored.

These soils have moderate limitations if used as sites

for septic tank absorption fields or hard-surfaced roads and streets. The moderate permeability and the shrink-swell potential of the Cordeston soil are the main limitations. Flooding and frost action are hazards. Measures that control flooding are needed. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste in the Cordeston soil. The effluent from waste disposal systems can pollute shallow ground water in areas of the Winetti soil. Constructing roads on raised, well compacted fill material and providing adequate roadside ditches and cu verts help to prevent the damage caused by shrinking and swelling, flooding, and frost action. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Cordeston soil is IVe-14, and the windbreak suitability group is 3. The land capability classification of the Winetti soil is VIs-4, and the windbreak suitability group is 10. The range site of both soils is Overflow.

DgB—Demar-Grummit-Slickspots complex, 0 to 6 percent slopes. This map unit consists of nearly level to gently sloping Demar and Grummit soils and Slickspots on low terraces and uplands. It is along streams and drainageways in the southwest part of the survey area. The Demar and Grummit soils formed in clayey material weathered from acid shale. The deep, moderately well drained Demar soil is on foot slopes and on micro-highs. The shallow, well drained Grummit soil is on side slopes and knolls. The Slickspots are in small, barren, low areas and micro-depressions. Elevation ranges from 3,500 to 4,000 feet above sea level. Annual precipitation ranges from 14 to 16 inches.

Areas of this map unit are irregular in shape and are 20 to 500 acres in size. They are 40 to 50 percent Demar soil, 20 to 30 percent Grummit soil, and 15 to 25 percent Slickspots. The two soils and Slickspots occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Demar soil is light brownish gray clay loam about 5 inches thick. The subsoil is pale brown and light brownish gray, very firm clay about 19 inches thick. The underlying material to a depth of about 60 inches is light brownish gray and pale brown clay. Accumulations of salts are in the lower part of the subsoil and in the underlying material. In some areas the soil is more alkaline. In other areas shale is at a depth of 20 to 40 inches.

Typically, the surface layer of the Grummit soil is gray clay about 4 inches thick. The underlying material also is gray clay. Shale fragments increase in size and amount with increasing depth. Dark gray, soft, acid shale is at a depth of about 16 inches. In some areas the content of gravel and cobbles in the surface layer is as much as 50 percent.

Typically, Slickspots have a light gray surface crust over dense, massive clay. They have visible salts at or near the surface and support little or no vegetation.

Included in this unit in mapping are small areas of Haverson, Pierre, and Arvada Variant soils. These soils make up less than 15 percent of any one mapped area. The deep Haverson soils have less clay and are more stratified than the Demar and Grummit soils. They are on low parts of the landscape. The moderately deep Pierre soils are alkaline. They are on high parts of the landscape. The poorly drained Arvada Variant soils are on low stream terraces below areas of the Demar soil.

Fertility and the content of organic matter are low in the Demar and Grummit soils. The available water capacity is low in the Demar soil and very low in the Grummit soil. Permeability is very slow in the Demar soil and moderately slow in the Grummit soil. The shrink-swell potential is high in both soils. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a hazard. Restricted grazing during wet periods helps to prevent compaction and the deterioration of tilth.

This map unit generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings.

The Demar and Grummit soils are severely limited as sites for dwellings because of the high shrink-swell potential. Backfilling with sandy material, installing foundation drains, and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Demar and Grummit soils have severe limitations if used as sites for septic tank absorption fields. The very slow permeability in the Demar soil and the shallowness to bedrock and seepage in the Grummit soil are the main limitations. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water. The very slow permeability restricts the movement of liquid waste. Absorption fields do not function well unless the absorption area is enlarged.

The Demar and Grummit soils have severe limitations if used as sites for hard-surfaced roads and streets. The high shrink-swell potential and low strength are the main limitations. Constructing roads on raised,

well compacted, coarse textured fill material and providing adequate roadside ditches and culverts help to minimize the damage caused by shrinking and swelling and by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Demar soil is VIs-3, the range site is Claypan, and the windbreak suitability group is 9. The land capability classification of the Grummit soil is VIe-12, the range site is Shallow Clay, and the windbreak suitability group is 10. The land capability classification of the Slickspots is VIIIs-3; no range site or windbreak suitability group is assigned.

GbA—Glenberg fine sandy loam, 0 to 4 percent slopes. This deep, well drained, occasionally flooded, nearly level and very gently sloping soil is on flood plains in the Red Valley and on the Dakota Hogback. It is dissected by streams characterized by very few meanders. It formed in calcareous, loamy alluvium. Elevation ranges from 3,200 to 4,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches. Areas are long and narrow and are 5 to 80 acres in size.

Typically, the surface layer is grayish brown, calcareous fine sandy loam about 5 inches thick. The underlying material to a depth of about 60 inches is pale brown and brown, calcareous, loamy fine sand and fine sandy loam. In some areas the surface layer has cobbles.

Included with this soil in mapping are small areas of Barnum and Winetti soils. These soils make up less than 15 percent of any one mapped area. Barnum soils have less sand and more clay than the Glenberg soil. They are on the slightly higher terraces. Winetti soils have more rock fragments than the Glenberg soil. They are next to stream channels.

Fertility is medium and the content of organic matter moderate in the Glenberg soil. Tilth is good. The available water capacity is moderate. Permeability is moderately rapid. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. Some areas along stream channels support bur oak, cottonwood, and green ash. The main management concerns are flooding, streambank erosion, and the moisture supply. Maintaining a good plant cover and ground mulch conserves moisture and helps to control the water erosion caused by flooding during periods of rapid snowmelt and heavy thunderstorms.

This soil is suited to cultivated crops and to tame pasture and hay. If irrigated, it is well suited to truck garden crops. Alfalfa, intermediate wheatgrass, and pubescent wheatgrass are suitable pasture plants. Small grain is the main crop. Measures that control flooding and wind erosion and conserve moisture are needed. Leaving crop residue on the surface helps to control wind erosion and conserves moisture. Installing dikes or diversions helps to control flooding.

This soil is well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well.

This soil is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets because of the flooding. Dwellings and septic tank absorption fields should be located on the adjacent upland soils. If dwellings are constructed on this soil, installing dikes protects the site against flooding. The sides of shallow excavations can cave in unless they are shored. Raising the road grade and diverting floodwater minimizes the damage caused by flooding.

The land capability classification is IVe-6, and the range site is Sandy. The windbreak suitability group is 1.

GrD—Grummit-Rock outcrop complex, 6 to 15 percent slopes. This map unit consists of a shallow, well drained, moderately sloping and strongly sloping Grummit soil intermingled with areas of Rock outcrop. It is on upland ridges and hills in the southwest part of the survey area. The Grummit soil formed in clayey material weathered from acid shale. It is on side slopes. The Rock outcrop is on ridges and escarpments. Elevation ranges from 3,500 to 4,000 feet above sea level. Annual precipitation ranges from 14 to 16 inches.

Areas of this map unit are irregular in shape and are 20 to 900 acres in size. They are 55 to 65 percent Grummit soil and 20 to 30 percent Rock outcrop. The Grummit soil and Rock outcrop occur as areas so closely intermingled or so small that separating them in mapping was not practical.

Typically, the surface layer of the Grummit soil is gray clay about 4 inches thick. The underlying material also is gray clay. Shale fragments increase in size and amount with increasing depth. Dark gray, soft, acid shale is at a depth of about 16 inches. In some areas the surface layer has gravel and cobbles. In other areas the depth to acid shale is 20 to 40 inches.

The Rock outcrop is dark gray to black, soft, acid shale.

Included in this unit in mapping are small areas of Arvada, Demar, and Pierre soils. These soils make up less than 15 percent of any one mapped area. The

deep Arvada and Demar soils have a high content of salts. They are on low parts of the landscape. The moderately deep Pierre soils are alkaline. They are in landscape positions similar to those of the Grummit soil.

Fertility and the content of organic matter are low in the Grummit soil. The available water capacity is very low. Permeability is moderately slow. The shrink-swell potential is high. Runoff is medium.

Most areas support native grasses and are used for grazing. Water erosion is a hazard. Gullies form along some cattle trails. Fencing and other means of controlling livestock traffic patterns help to control gullying. Reestablishing vegetation is difficult.

This unit generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings.

The Grummit soil is severely limited as a site for dwellings. The high shrink-swell potential is the main limitation. Backfilling with sandy material, installing foundation drains, and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage.

The Grummit soil has severe limitations if used as a site for septic tank absorption fields. The shallowness to bedrock and seepage are the main limitations. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water. Better suited sites generally are available.

This map unit has severe limitations if used as a site for hard-surfaced roads and streets. The high shrink-swell potential and low strength in the Grummit soil are the main limitations. Constructing the roads on raised, well compacted fill material and diverting runoff away from the roads help to prevent the damage caused by shrinking and swelling. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Unsurfaced roads in areas of Rock outcrop may require additions of borrow material. Applying gravel to unsurfaced roads improves the traffic-supporting capacity during wet periods.

The land capability classification of the Grummit soil is VIe-12, the range site is Shallow Clay, and the windbreak suitability group is 10. The land capability classification of the Rock outcrop is VIIIs-2; no range site or windbreak suitability group is assigned.

GrF—Grummit-Rock outcrop complex, 15 to 60 percent slopes. This map unit consists of a shallow, well drained, moderately steep to very steep Grummit soil intermingled with areas of Rock outcrop. It is on upland ridges in the southwest part of the survey area. The Grummit soil formed in clayey material weathered from acid shale. It is on side slopes. The Rock outcrop is on ridges and escarpments. Elevation ranges from 3,500 to 4,000 feet above sea level. Annual precipitation ranges from 14 to 16 inches.

Areas of this map unit are irregular in shape and are 50 to 1,400 acres in size. They are 45 to 55 percent Grummit soil and 30 to 40 percent Rock outcrop. The Grummit soil and Rock outcrop occur as areas so closely intermingled or so small that separating them in mapping was not practical.

Typically, the surface layer of the Grummit soil is gray clay about 4 inches thick. The underlying material also is gray clay. Shale fragments increase in size and amount with increasing depth. Dark gray, soft, acid shale is at a depth of about 16 inches. In some areas the content of gravel and small cobbles in the surface layer is as much as 50 percent. In other areas the depth to bedrock is 20 to 40 inches.

The Rock outcrop is dark gray to black, soft, acid shale.

Included in this unit in mapping are small areas of Butche and Pierre soils. These soils make up less than 15 percent of any one mapped area. Butche soils have sandstone at a depth of 10 to 20 inches. They are on high parts of the landscape. Pierre soils are alkaline and have shale at a depth of 20 to 40 inches. They are in landscape positions similar to those of the Grummit soil.

Fertility and the content of organic matter are low in the Grummit soil. The available water capacity is very low. Permeability is moderately slow. The shrink-swell potential is high. Runoff is rapid.

Most areas support native grasses along with sparse stands of stunted ponderosa pine. Water erosion is a hazard. Maintaining a good plant cover helps to control water erosion. Reestablishing vegetation is difficult.

This map unit is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings.

This map unit has severe limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets. The shallowness to bedrock, the high shrink-swell potential, seepage, low strength, the moderately steep to very steep slopes, and the Rock outcrop are the main limitations. Better suited sites generally are available. Unsurfaced roads in areas of Rock outcrop may require additions of borrow material. Applying gravel to these roads improves the traffic-supporting capacity during wet periods.

The land capability classification of the Grummit soil is VIIe-5, the range site is Shallow Clay, and the

windbreak suitability group is 10. The land capability classification of the Rock outcrop is VIIIs-2; no range site or windbreak suitability group is assigned.

GuC—Gurney-Butche complex, 2 to 9 percent slopes. These gently sloping and moderately sloping soils are on mountain prairies on the Dakota Hogback. They formed in material weathered from sandstone and other sedimentary bedrock. The moderately deep, well drained Gurney soil is on side slopes and foot slopes. The shallow, excessively drained Butche soil is on ridges. Elevation ranges from 3,200 to 4,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 5 to 200 acres in size. They are 50 to 60 percent Gurney soil and 20 to 30 percent Butche soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Gurney soil is dark brown loam about 5 inches thick. The subsoil is brown, very friable loam in the upper part; light yellowish brown, friable clay loam in the next part; and yellowish brown, calcareous clay loam and channery clay loam in the lower part. Red, indurated sandstone is at a depth of about 28 inches. In some areas the depth to bedrock is more than 40 inches. In other areas the subsoil has less sand and more silt.

Typically, the surface layer of the Butche soil is dark grayish brown cobbly loam about 4 inches thick. The underlying material is pale brown, very friable cobbly loam. Very pale brown, hard sandstone is at a depth of about 10 inches. In some areas the bedrock is calcareous shale and weakly cemented sandstone. In other areas the soil has a higher content of sand.

Included with these soils in mapping are small areas of Lakoa and Rockoa soils and areas of Rock outcrop. Inclusions make up less than 20 percent of any one mapped area. The deep Lakoa and Rockoa soils are on low parts of the landscape. The Rock outcrop occurs as low ledges or slabs parallel to the surface.

Fertility is high in the Gurney soil and low in the Butche soil. The content of organic matter is high in the Gurney soil and low in the Butche soil. The available water capacity is low in the Gurney soil and very low in the Butche soil. Permeability is moderate in both soils. The shrink-swell potential is low in the Butche soil. It is moderate in the subsoil of the Gurney soil and low in the underlying material. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this unit for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity. Scattered stands of ponderosa pine are in some areas.

The Gurney soil is poorly suited to cultivated crops and to tame pasture and hay, and the Butche soil generally is unsuited because of the shallowness to bedrock. Alfalfa, intermediate wheatgrass, and pubescent wheatgrass are suitable pasture plants in areas of the Gurney soil. Alfalfa and oats are the main crops. Measures that control erosion and conserve moisture, such as leaving crop residue on the surface and minimizing tillage, are needed in cultivated areas of the Gurney soil.

These soils have severe limitations if used as sites for dwellings with basements or for hard-surfaced roads and streets. The Gurney soil has moderate limitations if used as a site for dwellings without basements. The depth to bedrock and low strength in the Gurney soil are the main limitations. Construction activities are hindered on these soils because of the depth to bedrock. Building roads and streets on coarse grained subgrade or base material helps to prevent the damage caused by low strength. Additions of borrow material may be needed in areas of the Butche soil. Applying gravel to unsurfaced roads improves the traffic-supporting capacity during wet periods.

These soils have severe limitations if used as sites for septic tank absorption fields. A thin layer of suitable material and seepage are the main limitations. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water. Better suited sites generally are available.

The land capability classification of the Gurney soil is IVs-4, the range site is Silty, and the windbreak suitability group is 6R. The land capability classification of the Butche soil is VIs-1, the range site is Shallow, and the windbreak suitability group is 10.

GvD—Gypnevee-Rekop-Rock outcrop complex, 6 to 15 percent slopes. This map unit consists of well drained, moderately sloping and rolling Gypnevee and Rekop soils intermingled with areas of Rock outcrop. It is on uplands in the Red Valley. The deep Gypnevee soil is on the smooth, lower side slopes and foot slopes. It formed in material weathered from reddish, gypsiferous siltstone. The shallow Rekop soil is on the higher side slopes. It formed in material weathered from gypsum and reddish, gypsiferous siltstone. The areas of Rock outcrop generally are on ridges and are barren. Most are less than 1 acre in size. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 1,000 acres in size. They are 45 to 55 percent Gypnevee soil, 20 to 30 percent Rekop soil, and 10 to 20 percent Rock outcrop. The two soils and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Gypnevee soil is reddish brown, calcareous silt loam about 8 inches thick. Below this is a transitional layer of red, friable, calcareous silt loam about 10 inches thick. The underlying material is light red and red, calcareous loam. Light red, gypsiferous siltstone and gypsum are at a depth of about 41 inches. In some areas the depth to bedrock is 20 to 40 inches.

Typically, the surface layer of the Rekop soil is reddish brown, calcareous loam about 4 inches thick. The underlying material is light reddish brown and pink, very friable, calcareous loam. White gypsum is at a depth of about 12 inches.

The Rock outcrop is light red, pinkish white, and white gypsum and alabaster. It occurs as small massive domes.

Included in this unit in mapping are small areas of Barnum, Nevee, and Tilford soils. These soils make up less than 15 percent of any one mapped area. They have less gypsum than the Gypnevee and Rekop soils. Barnum soils are on flood plains and low terraces. Nevee and Tilford soils are on low parts of the landscape. In some included areas next to the Dakota Hogback, large sandstone boulders are scattered on the surface. These areas have an overstory of ponderosa pine. Sinkholes are in some areas.

Fertility and the content of organic matter are low in the Gypnevee and Rekop soils. The available water capacity is moderate in the Gypnevee soil and very low in the Rekop soil. Permeability is moderate in both soils. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. Some areas have a sparse overstory of ponderosa pine. Water erosion is a hazard. Gullies form easily where runoff concentrates in cattle trails. Maintaining a good plant cover helps to control water erosion. Reestablishing vegetation is difficult in denuded areas.

This map unit generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings.

The Gypnevee and Rekop soils have moderate limitations if used as sites for dwellings. The Gypnevee soil has moderate limitations and the Rekop soil severe limitations if used as a site for septic tank absorption fields. Seepage, a thin layer of suitable material, and slope are the main limitations. Because of the high content of gypsum, these soils may subside as the gypsum is dissolved and removed. Diverting runoff away from dwellings helps to prevent subsidence. Land shaping and installing distribution lines across the slope help to ensure that the absorption fields function adequately. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water. Coating concrete and steel helps to prevent the damage caused by the high corrosivity of these soils.

The Gypnevee and Rekop soils are moderately limited as sites for hard-surfaced roads and streets because of the slope. Building the roads and streets on the contour helps to overcome the slope. Additions of borrow material may be needed in areas of the Rekop soil. These soils erode easily. The hazard of erosion can be reduced by seeding disturbed areas. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Gypnevee and Rekop soils is VIe-3, and the windbreak suitability group is 10. The range site is Thin Upland for the Gypnevee soil and Shallow for the Rekop soil. The land capability classification of the Rock outcrop is VIIIs-1; no range site or windbreak suitability group is assigned.

GyD—Gypnevee-Rock outcrop-Urban land complex, 9 to 25 percent slopes. This map unit consists of a deep, well drained, strongly sloping and moderately steep Gypnevee soil intermingled with areas of Rock outcrop and Urban land. It is on uplands in the Red Valley. The Gypnevee soil formed in material weathered from reddish, gypsiferous siltstone. It is on smooth side slopes. The areas of Rock outcrop generally are on the highest ridges and are less than 1 acre in size. The Urban land is in scattered areas throughout the unit. Elevation ranges from 3,200 to 3,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 400 acres in size. They are 35 to 45 percent Gypnevee soil, 20 to 30 percent Rock outcrop, and 20 to 30 percent Urban land. The Gypnevee soil, Rock outcrop, and Urban land occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Gypnevee soil is reddish brown, calcareous silt loam about 8 inches thick. Below this is a transitional layer of red, friable, calcareous silt loam about 10 inches thick. The underlying material is light red and red, calcareous loam. Light red, gypsiferous siltstone and gypsum are at

a depth of about 41 inches. In some areas the depth to bedrock is 20 to 40 inches.

The Rock outcrop is light red, pinkish white, and white gypsum and alabaster bedrock. It occurs as low-relief, small domes or narrow ledges.

The Urban land is in areas that have been cut, buried, compacted, or disturbed in some way and now are covered with paved parking lots, streets, or buildings. Because the landscape has been altered and the soils covered with urban structures, identification of the soil series is not feasible.

Included in this unit in mapping are small areas of Rekop, Spearfish, and Tilford soils. These soils make up less than 15 percent of any one mapped area. The shallow Rekop and Spearfish soils are adjacent to the areas of Rock outcrop. The deep Tilford soils are on low parts of the landscape. They have a thick, dark surface layer and contain less gypsum than the Gypnevee soil. Sinkholes are in some included areas.

Fertility and the content of organic matter are low in the Gypnevee soil. The available water capacity is moderate. Permeability also is moderate. Runoff is medium.

The Gypnevee soil is used for lawns or gardens or as a building site. Fertilizers are needed in areas used for lawns, gardens, trees, or shrubs. In addition, irrigation is needed during dry periods. In some areas excessive irrigation may cause subsidence or the formation of sinkholes.

This map unit has severe limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets. Slope is the main limitation. The Rock outcrop also is a limitation. Coating concrete and steel helps to prevent the damage caused by the high corrosivity of the Gypnevee soil. This soil erodes easily. The hazard of erosion can be reduced by seeding disturbed areas. Designing dwellings so that they conform to the natural slope of the land helps to reduce the amount of land shaping needed to overcome the slope. Diverting runoff away from buildings helps to prevent subsidence. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function adequately. Because of the high content of gypsum, the Gypnevee soil may subside as the gypsum is dissolved and removed. Building roads and streets on the contour helps to overcome the slope.

No interpretive groups are assigned to this map unit.

HaA—Haverson loam, 0 to 2 percent slopes. This deep, well drained, rarely flooded, nearly level soil is on flood plains in the southwestern part of the survey area. It generally is dissected by meandering streams. It formed in calcareous, loamy alluvium. Elevation ranges from 3,500 to 4,500 feet above sea level. Annual precipitation ranges from 14 to 18 inches. Areas are elongated and are 5 to 500 acres in size.

Typically, the surface layer is light brownish gray, calcareous loam about 4 inches thick. The underlying material to a depth of about 60 inches occurs as strata of light brownish gray, calcareous fine sandy loam, silt loam, clay loam, and loam. In some areas the surface layer is darker and thicker. In other areas the underlying material has more clay.

Included with this soil in mapping are small areas of Arvada and Satanta soils. These soils make up less than 15 percent of any one mapped area Arvada soils have a sodium affected subsoil and a high content of salts. They are on terraces and benches above the Haverson soil. Satanta soils are not so stratified as the Haverson soil. They are on high parts of the landscape.

Fertility and the content of organic matter are low in the Haverson soil. Tilth is good. The available water capacity is high. Permeability is moderate. Runoff is slow.

Most of the acreage is cultivated. Some areas support green ash and cottonwood. This soil is suited to crops. Conserving moisture, improving fertility, and controlling flooding are management concerns. Minimizing tillage and leaving crop residue on the surface help to conserve moisture and maintain or improve fertility. In places dikes or channels can be constructed to divert floodwater. Most areas are irrigated when a sufficient supply of water is available.

This soil is well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth brome are suitable pasture plants.

This soil is well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is severely limited as a site for dwellings because of the flooding. If buildings are constructed on this soil, installing dikes may protect the site against flooding.

This soil is moderately limited as a site for septic tank absorption fields because of the flooding. Measures that control flooding are needed. Enlarging the absorption area helps to overcome the slow absorption of liquid waste.

This soil is moderately limited as a site for hard-

surfaced roads and streets. Flooding is a hazard. Raising the road grade and diverting floodwater minimizes the damage caused by flooding.

The land capability classification is IIIc-2, and the range site is Loamy Terrace. The windbreak suitability group is 1.

HeE—Heely channery loam, 9 to 30 percent slopes. This moderately deep, well drained, strongly sloping to very hilly soil is on mountain prairies in the Central Crystalline Area. It formed in material weathered from metamorphic rock. Elevation ranges from 4,600 to 6,200 feet above sea level. Annual precipitation ranges from 18 to 22 inches. Areas are irregular in shape and are 10 to 1,000 acres in size.

Typically, the surface layer is very dark grayish brown channery loam about 6 inches thick. The subsoil is about 16 inches thick. It is dark grayish brown, friable very flaggy loam in the upper part and light olive brown and dark grayish brown, firm and very flaggy and extremely flaggy sandy loam in the lower part. The underlying material is grayish brown, firm extremely flaggy sandy loam about 5 inches thick. Grayish brown, steeply tilted metamorphic rock is at a depth of about 27 inches. In some areas the depth to bedrock is less than 20 inches. In other areas the subsoil has more clay or more mica.

Included with this soil in mapping are small areas of Buska, Cordeston, and Pactola soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. Buska and Pactola soils are in forested areas along the edges of the unit. They have a light colored subsurface layer. Also, Buska soils have more mica than the Heely soil. Cordeston soils have fewer coarse fragments than the Heely soil. They are in swales. Also included are scattered areas where slate and schist outcrops project a few inches to several feet above the surface.

Fertility is medium and the content of organic matter moderate in the Heely soil. The available water capacity is very low. Permeability is moderate. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings.

This soil has severe limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets. The moderate depth to bedrock, large stones, seepage, and the slope are the main limitations. Construction activities are hindered because of numerous large rock fragments. Dwellings should be constructed without basements because of the depth to bedrock. Designing the dwellings so that they conform to the natural slope of the land reduces the amount of land shaping needed to overcome the slope. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water. Building roads and streets on the contour helps to overcome the slope. Borrow material may be needed in some areas.

The land capability classification is VIIe-1, and the range site is Mountain Prairie. The windbreak suitability group is 10.

HfC—Heely-Cordeston complex, 6 to 15 percent slopes. These well drained, moderately sloping and rolling soils are on mountain prairie uplands and swales in the Central Crystalline Area. The moderately deep Heely soil formed in material weathered from metamorphic rock. It is on side slopes and ridges. The deep, rarely flooded Cordeston soil formed in loamy alluvium weathered from metamorphic rock. It is on toe slopes. Elevation ranges from 4,600 to 6,200 feet above sea level. Annual precipitation ranges from 18 to 22 inches.

Areas of this map unit are irregular in shape and are 10 to 1,400 acres in size. They are 50 to 60 percent Heely soil and 25 to 35 percent Cordeston soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Heely soil is very dark grayish brown channery loam about 6 inches thick. The subsoil is about 16 inches thick. It is dark grayish brown, friable very flaggy loam in the upper part; light olive brown, firm very flaggy sandy loam in the next part; and dark grayish brown, firm extremely flaggy sandy loam in the lower part. The underlying material is grayish brown extremely flaggy sandy loam about 5 inches thick. Grayish brown, steeply tilted metamorphic rock is at a depth of about 27 inches. In some areas the depth to bedrock is less than 20 inches. In other areas the subsoil has more clay or more mica.

Typically, the surface layer of the Cordeston soil is very dark gray loam about 10 inches thick. The subsoil is very dark gray and dark grayish brown, very friable loam about 35 inches thick. The underlying material to a depth of about 60 inches is brown loam. In some areas the soil is dark to a depth of less than 40 inches and has more clay in the subsoil. In other areas the subsoil

and underlying material have a higher content of rock fragments.

Included with these soils in mapping are small areas of Buska and Pactola soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. The deep Buska and Pactola soils are less stratified than the Cordeston soil. They are in forested areas along the edges of the unit. Buska soils have more mica than the Heely and Cordeston soils. Also included, on high parts of the landscape, are areas where slate and schist outcrops project a few inches to several feet above the surface.

Fertility is medium in the Heely soil and high in the Cordeston soil. The content of organic matter is moderate in the Heely soil and high in the Cordeston soil. The available water capacity is very low in the Heely soil and high in the Cordeston soil. Permeability is moderate in both soils. The shrink-swell potential is low in the Heely soil. It is moderate in the subsoil of the Cordeston soil and low in the underlying material. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used for grazing. Some areas of the Cordeston soil support snowberry and wild rose. No major hazards or limitations affect the use of this map unit for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This map unit generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. Rock fragments in the Heely soil and the inaccessibility of the isolated narrow areas of the Cordeston soil are the main limitations. The broader areas of the Cordeston soil are accessible and can be used for these purposes.

These soils have severe limitations if used as sites for dwellings. The depth to bedrock is the main limitation. Flooding is a hazard on the Cordeston soil. Construction activities are hindered on the Heely soil because of numerous large rock fragments and bedrock. If dwellings are constructed on the Cordeston soil, installing dikes may protect the site against flooding.

The Heely soil has severe limitations and the Cordeston soil moderate limitations if used as a site for septic tank absorption fields. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water in the Heely soil. Measures that control flooding are needed. Enlarging the absorption area helps to overcome the slow absorption of liquid waste in the Cordeston soil. Land shaping and installing the distribution lines on the contour help to overcome the slope.

The Heely soil has severe limitations and the Cordeston soil moderate limitations if used as a site for hard-surfaced roads and streets. The flooding, the shrink-swell potential, and the slope are the main limitations. Constructing roads on raised, well compacted, coarse textured fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by flooding and by shrinking and swelling in areas of the Cordeston soil. Construction activities are hindered on the Heely soil because of numerous large rock fragments. Building the roads and streets on the contour helps to overcome the slope. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Heely soil is VIe-13, the range site is Mountain Prairie, and the windbreak suitability group is 10. The land capability classification of the Cordeston soil is IVe-1, the range site is Overflow, and the windbreak suitability group is 3.

HgB—Hilger cobbly loam, 0 to 6 percent slopes. This deep, well drained, nearly level and gently sloping soil is on high terraces in the Red Valley and at the lower elevations on the Limestone Plateau. It formed in loamy alluvium weathered from igneous, metamorphic, and sedimentary rock. Elevation ranges from 3,400 to 5,500 feet above sea level. Annual precipitation ranges from 17 to 20 inches. Areas are irregular in shape and are 5 to 150 acres in size.

Typically, the surface layer is very dark gray cobbly loam about 5 inches thick. The subsoil is about 21 inches thick. It is dark grayish brown, friable very cobbly loam in the upper part; brown, firm very cobbly clay loam in the next part; and very pale brown, friable, calcareous very cobbly loam in the lower part. The underlying material to a depth of about 60 inches is light brownish gray, calcareous extremely cobbly loam. In some areas, dark colors extend to a depth of 20 inches and carbonates are at a depth of more than 20 inches. In other areas the subsoil and underlying material have fewer rock fragments.

Included with this soil in mapping are small areas of Bullflat and Metre soils. These soils make up less than 15 percent of any one mapped area. They are in landscape positions similar to those of the Hilger soil. Bullflat soils have fewer coarse rock fragments than the Hilger soil. Metre soils are moderately deep and contain

more clay than the Hilger soil.

Fertility is medium and the content of organic matter moderate in the Hilger soil. Permeability is moderate. The available water capacity is low. The shrink-swell potential is moderate in the subsoil and low in the underlying material. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. Ponderosa pine has encroached in some areas. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings because it has cobbles throughout.

This soil is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. Construction activities are hindered because of the numerous large rock fragments.

The land capability classification is VIs-4, and the range site is Stony Hills. The windbreak suitability group is 10.

HgD—Hilger cobbly loam, 6 to 40 percent slopes. This deep, well drained, moderately sloping to steep soil is on side slopes of high terraces in the Red Valley and at the lower elevations on the Limestone Plateau. It formed in loamy alluvium weathered from igneous, metamorphic, and sedimentary rock. Elevation ranges from 3,400 to 5,500 feet above sea level. Annual precipitation ranges from 17 to 20 inches. Areas are irregular in shape and are 10 to 650 acres in size.

Typically, the surface layer is very dark gray cobbly loam about 5 inches thick. The subsoil is about 21 inches thick. It is dark grayish brown, friable very cobbly loam in the upper part and brown, firm very cobbly clay loam and very pale brown, friable, calcareous very cobbly loam in the lower part. The underlying material to a depth of about 60 inches is light brownish gray, calcareous extremely cobbly loam. In some areas the surface layer and subsoil are thinner. In other areas the subsoil is redder and has less clay.

Included with this soil in mapping are small areas of Hopdraw, Norrest, and Sawdust soils. These soils make up less than 15 percent of any one mapped area. They are in landscape positions similar to those of the Hilger soil. Hopdraw soils have more sand than the Hilger soil. Norrest soils have fewer cobbles and more clay, and Sawdust soils have less clay.

Fertility is medium and the content of organic matter moderate in the Hilger soil. The available water capacity is low. Permeability is moderate. The shrink-swell potential is moderate in the subsoil and low in the underlying material. Runoff is medium or rapid.

Most of the acreage supports native grasses and is used for grazing. Ponderosa pine has encroached in some areas. Controlling water erosion in the steeper areas is a management concern. Measures that maintain an adequate ground cover, such as proper stocking rates and timely deferment of grazing, help to control water erosion.

This soil generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings because of the cobbles throughout the profile and the slope.

This soil has severe limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets. The large stones and the slope are the main limitations. Construction activities are hindered because of the numerous large rock fragments. Designing dwellings so that they conform to the natural slope of the land reduces the amount of land shaping needed to overcome the slope. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. Building roads and streets on the contour helps to overcome the slope.

The land capability classification is VIe-13, and the range site is Stony Hills. The windbreak suitability group is 10.

HmE—Hilger-Metre complex, 10 to 40 percent slopes. These well drained, strongly sloping to steep soils are on ridges and side slopes on old terraces and uplands in the Red Valley. The deep Hilger soil formed in loamy colluvium weathered from igneous, metamorphic, and sedimentary rock. It is on the higher side slopes. The moderately deep Metre soil formed in material weathered from mudstone. It is on foot slopes. Scattered cobbles and stones 3 to 15 inches in diameter are on the surface. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 5 to 1,400 acres in size. They are 55 to 65 percent Hilger soil and 20 to 30 percent Metre soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Hilger soil is dark reddish gray cobbly loam about 6 inches thick. The subsoil is about 22 inches thick. It is reddish brown, friable cobbly loam in the upper part and reddish brown, firm very cobbly clay loam in the lower part. The

underlying material to a depth of about 60 inches is red and pink, very friable, calcareous extremely cobbly loam. In some areas the soil is more yellow. In other areas the subsoil has more clay.

Typically, the surface layer of the Metre soil is very dark grayish brown clay about 5 inches thick. The subsoil is very dark gray, dark gray, reddish gray, and reddish brown, very firm and extremely firm, calcareous clay about 31 inches thick. Reddish brown, soft mudstone is at a depth of about 36 inches. In some areas the mudstone is below a depth of 40 inches.

Included with these soils in mapping are small areas of Nihill, Norrest, and Tilford soils. These included soils make up less than 15 percent of any one mapped area. The deep Nihill soils have less clay in the subsoil than the Hilger soil and are calcareous to the surface. They are on high parts of the landscape. The moderately deep Norrest soils have less clay than the Metre soil. Tilford soils have fewer cobbles than the Hilger soil. Norrest and Tilford soils are in landscape positions similar to those of the Metre soil.

Fertility is medium and the content of organic matter moderate in the Hilger and Metre soils. The available water capacity is low. Permeability is moderate in the Hilger soil and very slow in the Metre soil. The shrink-swell potential is moderate in the subsoil of the Hilger soil and low in the underlying material. It is very high in the Metre soil. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used for grazing. Some areas support scattered stands of ponderosa pine. Measures that maintain an adequate ground cover, such as proper stocking rates and timely deferment of grazing, help to control erosion in the steeper areas.

These soils generally are unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings because of the cobbles in the Hilger soil and the slope of both soils. Windbreaks can be established in the less sloping areas of the Metre soil. The clayey subsoil of this soil restricts root penetration. As a result, optimum growth is unlikely. Planting the trees and shrubs on the contour helps to control water erosion.

These soils have severe limitations if used as sites for dwellings, septic tank absorption fields, or hard-surfaced roads and streets. The slope of both soils, numerous large rock fragments in the Hilger soil, and the moderate depth to bedrock, very slow permeability, and very high shrink-swell potential in the Metre soil are the main limitations. Better suited sites generally are available. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Hilger soil is VIe-3, the range site is Stony Hills, and the windbreak suitability group is 10. The land capability classification of the Metre soil is VIe-4, the range site is Clayey, and the windbreak suitability group is 4C.

HnB—Hilger-Urban land complex, 0 to 6 percent slopes. This map unit consists of a deep, well drained, nearly level and gently sloping Hilger soil and areas of Urban land. It is on upland terraces along Rapid Creek in the Red Valley. The Hilger soil formed in loamy alluvium weathered from igneous, metamorphic, and sedimentary rock. Elevation ranges from 3,200 to 3,600 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 5 to 100 acres in size. They are 60 to 70 percent Hilger soil and 15 to 25 percent Urban land. The Hilger soil and Urban land occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Hilger soil is very dark gray cobbly loam about 5 inches thick. The subsoil is about 21 inches thick. It is dark grayish brown, friable very cobbly loam in the upper part; brown, firm very cobbly clay loam in the next part; and very pale brown, friable, calcareous very cobbly loam in the lower part. The underlying material to a depth of about 60 inches is light brownish gray, calcareous extremely cobbly loam. In some areas, the dark colors extend to a depth of 20 inches or more and the depth to carbonates is more than 20 inches. In other areas the subsoil and underlying material have fewer rock fragments.

The Urban land is in areas that have been cut, buried, compacted, or disturbed in some way and now are covered with paved parking lots, streets, or buildings. Because the landscape has been altered and the soils covered with urban structures, identification of the soil series is not feasible.

Included in this unit in mapping are small areas of Bullflat, Gypnevee, and Tilford soils. These soils make up less than 15 percent of any one mapped area. They have fewer coarse rock fragments than the Hilger soil. In addition, Gypnevee soils have gypsum crystals throughout. They are generally on high parts of the landscape. Bullflat soils are in landscape positions similar to those of the Hilger soil. Tilford soils are on low parts of the landscape.

Fertility is medium and the content of organic matter

moderate in the Hilger soil. The available water capacity is low. Permeability is moderate. Runoff is medium.

Most of the acreage is developed for residential uses, such as lawns, gardens, and dwelling sites. The Hilger soil is well suited to grasses, flowers, vegetables, trees, and shrubs. All climatically suited species grow well if the site is irrigated during dry periods.

This map unit has severe limitations if used as a site for dwellings or hard-surfaced roads and streets. Construction activities are hindered on the Hilger soil because of the numerous large rock fragments. Designing dwellings and roads that require limited excavation minimizes the problems caused by the rock fragments.

No interpretive groups are assigned to this map unit.

HoD—Hilger-Virkula complex, 2 to 30 percent slopes. These deep, well drained, gently sloping to steep soils are on fans and mountain canyon side slopes in the Central Crystalline Area and at the lower elevations on the Limestone Plateau. The Hilger soil formed in alluvium derived from igneous, metamorphic, and sedimentary rocks. It is on steep side slopes. The Virkula soil formed in material weathered from metamorphic rocks. It is on the less sloping side slopes. Elevation ranges from 3,400 to 5,500 feet above sea level. Annual precipitation ranges from 17 to 20 inches.

Areas of this map unit are irregular in shape and are 5 to 90 acres in size. They are 45 to 55 percent Hilger soil and 30 to 40 percent Virkula soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Hilger soil is very dark gray cobbly loam about 5 inches thick. The subsoil is about 21 inches thick. It is dark grayish brown, friable very cobbly loam in the upper part; brown, firm very cobbly clay loam in the next part; and very pale brown, friable, calcareous very cobbly loam in the lower part. The underlying material to a depth of about 60 inches is light brownish gray, calcareous extremely cobbly loam. In some areas the soil has a thinner surface layer and has a gray subsurface layer.

Typically, about 1 inch of forest litter is on the surface of the Virkula soil. The surface layer is brown silt loam about 1 inch thick. The subsurface layer also is brown silt loam. It is about 3 inches thick. The subsoil is silty clay loam about 41 inches thick. It is yellowish brown and firm in the upper part and pale brown, firm, and calcareous in the lower part. The underlying material to a depth of about 60 inches is pale brown, calcareous cobbly clay loam. In some areas the surface layer is thicker.

Included with these soils in mapping are small areas of Cordeston, Pactola, and Winetti soils and areas of Rock outcrop. Also included are small areas where stones cover as much as 25 percent of the surface. Inclusions make up less than 15 percent of any one mapped area. The stratified Cordeston and Winetti soils are on flood plains. Pactola soils have more rock fragments than the Virkula and Hilger soils and a lighter colored surface layer than the Hilger soil. They are in landscape positions similar to those of the Virkula soil. The Rock outcrop is along the edges of the map unit and on high parts of the landscape.

The available water capacity is low in the Hilger soil and high in the Virkula soil. Permeability is moderate in the Hilger soil and moderately slow in the Virkula soil. The shrink-swell potential is low in the subsoil of the Hilger soil and moderate in the underlying material. It is moderate in the Virkula soil. Runoff is medium on both soils.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 65 on the Hilger soil and 72 on the Virkula soil. Some quaking aspen, bur oak, Black Hills spruce, and paper birch grow in most areas. The understory is dominantly big bluestem, sedges, wheatgrass, prairie dropseed, needlegrass, leadplant, russet buffaloberry, snowberry, and chokecherry.

When the Virkula soil is wet, logging activities, such as skidding, hauling, and construction, can cause surface compaction and the formation of ruts. These activities should be restricted to periods when the soil is dry or frozen. Erosion can be controlled by seeding disturbed areas and by installing water bars and culverts.

These soils are well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. The number of suitable sites for watering facilities is limited.

These soils have severe limitations if used as sites for dwellings or hard-surfaced roads and streets. Large stones in the Hilger soil, low strength in the Virkula soil, and the slope of both soils are the main limitations. Construction activities are hindered on the Hilger soil because of numerous large rock fragments. Constructing buildings in the less sloping areas and designing the buildings so that they conform to the natural slope of the land reduce the amount of land shaping needed to overcome the slope. Building hard-surfaced roads and streets on the contour helps to overcome the slope. Providing coarse grained subgrade

or base material helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

These soils have severe limitations if used as sites for septic tank absorption fields. Large stones in the Hilger soil, the moderately slow permeability in the Virkula soil, and the slope of both soils are the main limitations. Selecting the less sloping areas, land shaping, and installing distribution lines across the slope help to ensure that the absorption fields function properly. Installation activities are hindered on the Hilger soil because of numerous large rock fragments. Enlarging the absorption area helps to overcome the moderately slow permeability in areas of the Virkula soil.

The land capability classification is VIe-13. The grazable woodland group is Rocky Side Slopes for the Hilger soil and Silty Foot Slopes for the Virkula soil.

HtG—Hopdraw-Sawdust-Rock outcrop complex, 40 to 80 percent slopes. This map unit consists of deep, very steep Hopdraw and Sawdust soils intermingled with areas of Rock outcrop. It is on the sides of mountain valleys and canyons in the southern part of the Limestone Plateau (fig. 7). The excessively drained Hopdraw and well drained Sawdust soils formed in material weathered from sandstone and limestone. They are on side slopes and foot slopes. The Rock outcrop is on ridges. Elevation ranges from 3,500 to 6,000 feet above sea level. Annual precipitation ranges from 16 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to several thousand acres in size. They are 40 to 50 percent Hopdraw soil, 25 to 35 percent Sawdust soil, and 10 to 20 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Hopdraw soil is grayish brown, calcareous cobbly loamy fine sand about 3 inches thick. The underlying material is pale brown, light gray, and very pale brown, loose, calcareous very gravelly loamy fine sand. Pink, calcareous, hard sandstone is at a depth of about 44 inches. In some areas the soil is noncalcareous. In other areas it has fewer pebbles and cobbles.

Typically, the surface layer of the Sawdust soil is dark grayish brown, calcareous channery loam about 4 inches thick. The next 4 inches is pale brown, friable, calcareous very channery loam. The upper part of the underlying material is light yellowish brown, calcareous very channery loam. The next part is very pale brown, calcareous extremely channery loam. The lower part to a depth of about 60 inches is yellow, calcareous extremely channery sandy loam. In some areas bedrock is at a depth of 20 to 40 inches.

The Rock outcrop is very pale brown, reddish, and yellowish sandstone and limestone ledges. In some areas weathering has caused rock slides below the Rock outcrop.

Included in this unit in mapping are small areas of Paunsaugunt, Vanocker, and Winetti soils. These soils make up less than 15 percent of any one mapped area. Paunsaugunt soils have bedrock at a depth of 10 to 20 inches. They are generally adjacent to the Rock outcrop. Vanocker soils have more clay in the subsoil than the Hopdraw or Sawdust soil. They are on low parts of the landscape. Winetti soils formed in alluvium and are along drainageways.

The available water capacity is very low in the Hopdraw soil and medium in the Sawdust soil. Permeability is rapid in the Hopdraw soil and moderate in the Sawdust soil. Runoff is medium on the Hopdraw soil and rapid on the Sawdust soil.

Most areas are forested. The canopy is sparse. The overstory is dominantly ponderosa pine. The Hopdraw and Sawdust soils support some Rocky Mountain juniper. In some areas the overstory is dominantly tall shrubs. The soils have a limited potential for timber. The site index for ponderosa pine is about 30 on the Hopdraw soil and 45 on the Sawdust soil. The understory is dominantly little bluestem, sideoats grama, sedges, oatgrass, mountainmahogany, skunkbush sumac, common juniper, and yucca.

The slope and the hazard of water erosion are management concerns in timbered areas. When timber is harvested, using a cable logging system helps to overcome the slope. Mass soil movement or slippage may occur when the soils are disturbed. The hazard of erosion can be reduced by seeding disturbed areas.

This unit is poorly suited to livestock grazing because of the very steep slopes. It is well suited to grazing by big game animals because the browse species include mountainmahogany and skunkbush sumac.

This unit has severe limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets because of the very steep slopes and the Rock outcrop. Better suited sites generally are available.

The land capability classification is VIIe-9 for the Hopdraw and Sawdust soils and VIIIs-1 for the Rock outcrop. No grazable woodland group is assigned.

Figure 7.—An area of Hell Canyon in Custer County. The very steep canyon walls are in an area of the Hopdraw-Sawdust-Rock outcrop complex, 40 to 80 percent slopes. The Barnum-Winetti complex, 0 to 6 percent slopes, is in the valley.

JhD—Judy-Heath-Paunsaugunt Variant complex, 2 to 25 percent slopes. These well drained, gently sloping to hilly soils are on ridges and side slopes in mountain valley meadows. They are at the higher elevations on the Limestone Plateau. They formed in material weathered from limestone and calcareous sandstone. The moderately deep Judy soil is on side slopes. The deep Heath soil is on foot slopes. The shallow Paunsaugunt Variant soil is on ridges and the steeper side slopes. Elevation ranges from 6,200 to 7,000 feet above sea level. Annual precipitation ranges from 20 to 24 inches.

Areas of these soils are irregular in shape and are 10 to 400 acres in size. They are 35 to 45 percent Judy soil, 30 to 40 percent Heath soil, and 15 to 25 percent Paunsaugunt Variant soil. The three soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Judy soil is dark brown silt loam about 6 inches thick. The next layer is reddish brown silty clay loam about 3 inches thick. The subsoil is reddish brown, firm silty clay in the upper part and reddish brown, firm, calcareous silty clay loam in the lower part. Light gray limestone is at a depth of about 24 inches. In some areas the subsoil is yellower.

Typically, the surface layer of the Heath soil is dark grayish brown silt loam about 7 inches thick. The next layer is brown silty clay loam about 5 inches thick. The subsoil is about 30 inches thick. It is brown, firm silty clay loam in the upper part; brown, firm silty clay in the

next part; and light brown, calcareous silty clay loam in the lower part. The underlying material to a depth of about 60 inches is light brown, calcareous clay loam. In some areas the soil has a higher content of rock fragments. In other areas the subsoil has less clay.

Typically, the surface layer of the Paunsaugunt Variant soil is dark brown gravelly silt loam about 4 inches thick. The next layer is dark reddish gray, calcareous very gravelly loam. Light gray limestone is at a depth of about 11 inches. In some areas the transitional layer contains more clay.

Included with these soils in mapping are small areas of Redbird, Stovho, and Trebor soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. Redbird soils have a thick surface layer. They are along drainageways. Stovho and Trebor soils do not have a dark surface layer and formed under forest vegetation. The areas of Rock outcrop are on ridges and on the crests of the steeper slopes.

Fertility and the content of organic matter are high in the Judy and Heath soils. Fertility is medium and the content of organic matter moderate in the Paunsaugunt Variant soil. The available water capacity is low in the Judy soil, high in the Heath soil, and very low in the Paunsaugunt Variant soil. Permeability is slow in the Judy and Heath soils and moderate in the Paunsaugunt Variant soil. The shrink-swell potential is high in the Judy soil. It is high in the subsoil of the Heath soil and moderate in the underlying material. It is low in the Paunsaugunt Variant soil. Runoff is medium on all three soils.

Most of the acreage supports native grasses and is used for grazing. A cold soil temperature limits plant growth. Delaying grazing until the soil has warmed and the forage species have achieved sufficient growth helps to prevent depletion of the desirable forage species.

This map unit generally is unsuited to cultivated crops and to windbreaks and environmental plantings because of a short growing season. Some areas of the Judy and Heath soils are suited to tame pasture and hay. Alsike clover, mountain brome, and bearded wheatgrass are examples of suitable pasture plants.

These soils have severe limitations if used as sites for dwellings. The high shrink-swell potential in the Judy and Heath soils and the depth to bedrock in the Judy and Paunsaugunt Variant soils are the main limitations. Diverting runoff away from buildings and reinforcing foundations and footings help to prevent the structural damage caused by shrinking and swelling. Excavation activities are hindered by the bedrock at a depth of 10 to 20 inches in the Paunsaugunt Variant soil and 20 to 40 inches in the Judy soil.

This map unit has severe limitations if used as a site for septic tank absorption fields. A thin layer of suitable material and seepage in the Judy and Paunsaugunt Variant soils and the slow permeability in the Heath soil are the main limitations. Enlarging the absorption area helps overcome the slow absorption of liquid waste in areas of the Heath soil. The effluent in septic tank absorption fields may not be adequately treated in the Judy and Paunsaugunt Variant soils. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water in those soils.

These soils have severe limitations if used as sites for hard-surfaced roads and streets. The high shrink-swell potential and low strength in the Judy and Heath soils and the depth to bedrock in the Paunsaugunt Variant soil are the main limitations. Constructing roads on coarse textured, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by low strength and by shrinking and swelling of the Judy and Heath soils. Borrow material may be needed in areas of the Paunsaugunt Variant soil. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Judy and Heath soils is VIe-13, and the range site is High Country Silty. The land capability classification of the Paunsaugunt Variant soil is VIIs-1, and the range site is High Country Shallow. The windbreak suitability group is 10 for all three soils.

MhA—Marshbrook loam, 0 to 3 percent slopes. This deep, poorly drained, very gently sloping soil is on flood plains of mountain valleys in the Central Crystalline Area. It typically is dissected by meandering perennial streams and is occasionally flooded for brief periods. It formed in alluvial material weathered from slate, quartzite, and schist. Elevation ranges from 4,000 to 6,200 feet above sea level. Annual precipitation ranges from 18 to 22 inches. Areas are long and narrow and are 20 to 200 acres in size.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsurface layer is dark grayish brown loam about 16 inches thick. The subsoil is grayish brown, friable loam about 16 inches thick. The upper part of the underlying material is dark grayish brown, gravelly loam. The lower part to a depth of about 60 inches is dark gray gravelly sandy loam. In some areas the soil has a higher content of coarse fragments throughout.

Included with this soil in mapping are small areas of the well drained Cordeston, Hilger, Pactola, and Virkula soils. These soils make up less than 15 percent of any one mapped area. They are on high parts of the landscape.

Fertility and the content of organic matter are high in the Marshbrook soil. The available water capacity is high. Permeability is moderately slow. The seasonal high water table is at a depth of 1 to 2 feet in most years. The shrink-swell potential is moderate in the subsoil and low in the underlying material. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. Willow, Black Hills spruce, and paper birch grow in some areas. In places the vegetation is dominantly slough sedge and bulrushes. Generally, no major hazards or limitations affect the use of this soil for range. Proper stocking rates and rotation grazing help to maintain maximum productivity.

This soil generally is unsuited to cultivated crops and poorly suited to tame pasture and hay. Garrison creeping foxtail and reed canarygrass are examples of suitable pasture plants. Flooding is a hazard. The seasonal high water table is the main limitation.

This soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

This soil has severe limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets. The wetness and the moderately slow permeability are the main limitations. Flooding and frost action are hazards. Better suited sites generally are available. Additions of borrow material may be required to protect unsurfaced roads during periods when the soil is flooded.

The land capability classification is Vw-1, and the range site is Subirrigated. The windbreak suitability group is 2.

MnC—Metre-Norrest complex, 2 to 9 percent slopes. These moderately deep, well drained, gently sloping and moderately sloping soils are in upland meadows in the Red Valley. They formed in material weathered from mudstone. The Metre soil is on the lower side slopes and on foot slopes. Gilgai relief is common in areas of this soil. The Norrest soil is on the upper side slopes and ridges. Elevation ranges from 3,200 to 5,000 feet above sea level. Annual precipitation ranges from 17 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to 900 acres in size. They are 45 to 55 percent Metre soil and 25 to 35 percent Norrest soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Metre soil is very dark grayish brown clay about 5 inches thick. The subsoil is very dark gray, light reddish brown, and reddish brown, very firm and extremely firm clay about 31 inches thick. It is calcareous in the lower part. Reddish brown, soft mudstone is at a depth of about 36 inches. In some areas the surface layer and the upper part of the subsoil are not so dark. In other areas bedrock is below a depth of 40 inches.

Typically, the surface layer of the Norrest soil is grayish brown cobbly silty clay loam about 4 inches thick. The subsoil is about 20 inches thick. It is brown and very pale brown, firm silty clay in the upper part and very pale brown, calcareous silty clay loam in the lower part. The underlying material is very pale brown, calcareous silty clay loam. Very pale brown, soft mudstone is at a depth of about 32 inches. In some areas bedrock is below a depth of 40 inches. In other areas the subsoil contains less clay.

Included with these soils in mapping are small areas of Hilger and Tilford soils. Also included are small areas where cobbles and stones cover as much as 25 percent of the surface. Included soils make up less than 15 percent of any one mapped area. Hilger soils have rock fragments throughout. They are on high parts of the landscape. Tilford soils have less clay in the subsoil than the Metre and Norrest soils. They are in landscape positions similar to those of the Norrest soil.

Fertility is medium and the content of organic matter moderate in the Metre and Norrest soils. The available water capacity is low. Permeability is very slow in the Metre soil and moderately slow in the Norrest soil. The shrink-swell potential is very high in the Metre soil and high in the Norrest soil. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a hazard. Restricted grazing during wet periods helps to prevent compaction and the deterioration of tilth.

This map unit is poorly suited to cultivated crops. Small grain, alfalfa, and sorghum are the main crops. Conserving moisture, maintaining tilth, and controlling erosion are management concerns. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system help to control wind erosion, maintain tilth, and conserve moisture. Contour farming and grassed waterways help to control water erosion.

These soils are suited to tame pasture and hay. Crested wheatgrass, green needlegrass, alfalfa, and

western wheatgrass are examples of suitable pasture plants.

These soils are suited to windbreaks and environmental plantings, but the clayey subsoil restricts the penetration of plant roots. Windbreaks can be established, but optimum growth and survival are unlikely. Planting on the contour helps to control water erosion.

These soils are severely limited as sites for dwellings because of the shrink-swell potential. Backfilling with sandy material, installing foundation drains, and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. The sides of shallow excavations in areas of the Metre soil can cave in unless they are shored.

This map unit has severe limitations if used as a site for septic tank absorption fields. A thin layer of suitable material and seepage are the main limitations. The effluent may not be adequately treated. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water. Liquid waste may surface on the lower parts of the landscape if the system does not function adequately or is improperly installed. Better suited sites generally are available.

These soils have severe limitations if used as sites for hard-surfaced roads and streets. The shrink-swell potential and low strength are the main limitations. Constructing roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by shrinking and swelling. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity during wet periods.

The land capability classification is IVe-3, and the range site is Clayey. The windbreak suitability group is 4C.

MsC—Mocmont gravelly loam, 2 to 12 percent slopes. This deep, well drained, gently sloping to strongly sloping soil is on broad ridgetops and smooth toe slopes on mountains in the Central Crystalline Area. It formed in material weathered from granitic rock. Elevation ranges from 4,500 to 6,200 feet above sea level. Annual precipitation ranges from 17 to 20 inches. Areas are irregular in shape and are 10 to 150 acres in size.

Typically, about 1 inch of forest litter is on the surface. The surface layer is dark grayish brown gravelly loam about 2 inches thick. The subsurface layer is very pale brown gravelly loam about 10 inches thick. The next 6 inches is light yellowish brown very gravelly clay loam and very pale brown very gravelly loam. The subsoil is light yellowish brown, friable and firm very gravelly clay loam about 32 inches thick. The underlying material to a depth of about 60 inches is light yellowish brown extremely gravelly loam. In some areas the subsoil is redder. In other areas the depth to bedrock is 40 to 60 inches.

Included with this soil in mapping are small areas of Buska, Cordeston, and Virkula soils, soils that have bedrock at a depth of less than 40 inches, and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. Buska soils formed in material weathered from micaceous schist. They are in landscape positions similar to those of the Mocmont soil. Cordeston soils have a thick, dark surface layer. They are along drainageways. Virkula soils have fewer coarse fragments than the Mocmont soil. They are on toe slopes or in swales. The Rock outcrop is granitic rock. It occurs as low-relief dikes or massive domes on high parts of the landscape. The soils that are less than 40 inches deep over bedrock are generally adjacent to the Rock outcrop.

The available water capacity is low in the Mocmont soil, and permeability is moderate. The shrink-swell potential is moderate in the subsoil and low in the underlying material. Runoff is medium.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 65. Quaking aspen, bur oak, and paper birch grow in some areas. The understory is dominantly little bluestem, needlegrass, sedges, leadplant, bearberry, and snowberry. Few limitations affect logging activities on this soil.

This soil is well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species.

This soil has moderate limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets. The moderate permeability and the shrink-swell potential are the main limitations. Frost action is a hazard. Backfilling with sandy material, installing foundation drains, and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Constructing roads and streets on well

compacted fill material and providing adequate drainage help to prevent the damage caused by frost action.

The land capability classification is VIe-13, and the grazable woodland group is Rocky Side Slopes.

MtE—Mocmont-Rock outcrop complex, 10 to 40 percent slopes. This map unit consists of a deep, well drained, strongly sloping to steep Mocmont soil intermingled with areas of Rock outcrop. It is on mountains in the Central Crystalline Area. The Mocmont soil formed in material weathered from granitic rock. The areas of Rock outcrop are less than 5 acres in size and generally are on ridges and the upper side slopes. Elevation ranges from 5,000 to 5,500 feet above sea level. Annual precipitation ranges from 18 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to several thousand acres in size. They are 55 to 65 percent Mocmont soil and 30 to 40 percent Rock outcrop. The Mocmont soil and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Mocmont soil. The surface layer is dark grayish brown gravelly loam about 2 inches thick. The subsurface layer is very pale brown gravelly loam about 10 inches thick. The next 6 inches is light yellowish brown very gravelly clay loam and very pale brown very gravelly loam. The subsoil is light yellowish brown, friable and firm very gravelly clay loam about 32 inches thick. The underlying material to a depth of about 60 inches is light yellowish brown extremely gravelly loam. In some areas the subsoil is redder. In other areas the depth to bedrock is 40 to 60 inches.

The Rock outcrop is gray, hard granite. It occurs as low- and high-relief, massive domes.

Included in this unit in mapping are small areas of Buska, Cordeston, and Virkula soils and soils that have bedrock at a depth of less than 40 inches. Included soils make up less than 20 percent of any one mapped area. Buska soils formed in material weathered from micaceous schist. They are in landscape positions similar to those of the Mocmont soil. Cordeston soils have a thick, dark surface layer. They are along drainageways. Virkula soils have fewer coarse fragments than the Mocmont soil. They are on concave side slopes and in swales. The soils that are less than 40 inches deep over bedrock are generally adjacent to areas of Rock outcrop.

The available water capacity is low in the Mocmont soil, and permeability is moderate. The shrink-swell potential is moderate in the subsoil and low in the underlying material. Runoff is medium.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine on the Mocmont soil is about 65. Some quaking aspen, paper birch, and bur oak grow on this map unit. The understory is dominantly little bluestem, needlegrass, sedges, leadplant, snowberry, and bearberry.

Some areas below the Rock outcrop have large boulders on the surface. These boulders interfere with felling, road construction, and the use of skidding equipment and other equipment. Erosion can be controlled by seeding disturbed areas and by installing water bars and culverts.

This map unit is suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. Because of the slope, watering facilities should be located on low parts of the landscape.

The Mocmont soil has severe limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets because of the slope. Better suited sites generally are available.

The land capability classification of the Mocmont soil is VIIe-9, and the grazable woodland group is Rocky Side Slopes. The land capability classification of the Rock outcrop is VIIIs-1; no grazable woodland group is assigned.

NaC—Nevee channery loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping and strongly sloping soil is on terraces and alluvial fans in the Red Valley. It formed in material weathered from reddish siltstone, sandstone, and silty shale. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches. Areas are irregular in shape and are 5 to 100 acres in size.

Typically, the surface layer is yellowish red and reddish yellow, calcareous channery loam about 8 inches thick. The subsurface layer is reddish yellow, calcareous channery loam about 4 inches thick. The underlying material to a depth of about 60 inches is reddish yellow and light red, calcareous channery loam. In places the soil has fewer channers.

Included with this soil in mapping are small areas of Tilford and Sawdust soils. These soils make up less than 15 percent of any one mapped area. Tilford soils have a dark surface layer and contain more clay throughout than the Nevee soil. They are on low parts of the landscape. Sawdust soils have more limestone fragments than the Nevee soil and are not so red. Also, they are higher on the landscape.

Fertility and the content of organic matter are low in the Nevee soil. The available water capacity and permeability are moderate. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Proper stocking rates and rotation grazing help to maintain maximum productivity.

This soil generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings because it has numerous rock fragments throughout.

This soil has moderate limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets. The slope, the moderate permeability, low strength, and the channers are the main limitations. Construction activities are hindered because of the numerous large rock fragments. Dwellings should be designed so that they conform to the natural slope of the land. Otherwise, excessive land shaping is needed to overcome the slope. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Building roads and streets on the contour helps to overcome the slope. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

The land capability classification is VIe-3, and the range site is Thin Upland. The windbreak suitability group is 10.

NbC—Nevee silt loam, 2 to 9 percent slopes. This deep, well drained, gently sloping and moderately sloping soil is on terraces and uplands in the Red Valley. It formed in material weathered from reddish siltstone, sandstone, and silty shale. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches. Areas are irregular in shape and are 10 to 300 acres in size.

Typically, the surface layer is yellowish red, calcareous silt loam about 8 inches thick. The underlying material to a depth of about 60 inches is firm, calcareous, reddish yellow silt loam and light red loam. In some areas the surface layer is darker. In other areas, the underlying material has less silt and the depth to bedrock is 20 to 40 inches.

Included with this soil in mapping are small areas of Gypnevee, Rekop, and Spearfish soils. These soils make up less than 15 percent of any one mapped area. Gypnevee soils have more than 40 percent, by weight, carbonates plus gypsum. They are in landscape positions similar to those of the Nevee soil. Rekop and Spearfish soils are shallow over bedrock. They are on high parts of the landscape.

Fertility and the content of organic matter are low in the Nevee soil. The available water capacity is high, and permeability is moderate. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. Controlling water erosion and conserving moisture are management concerns. Proper stocking rates and rotation grazing help to maintain a good plant cover and ground mulch, which help to control water erosion and conserve moisture.

This soil is suited to cultivated crops and to tame pasture and hay. Intermediate wheatgrass and pubescent wheatgrass are examples of suitable pasture plants. Oats and alfalfa are the main crops. Conserving moisture, improving fertility, and controlling water erosion are management concerns in cultivated areas. Leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system help to control water erosion and conserve moisture. Contour farming, terraces, and grassed waterways also help to control water erosion. Regular additions of organic material improve fertility.

This soil is suited to windbreaks and environmental plantings, but the high content of lime in the surface layer adversely affects the availability of plant nutrients. Plantings can be established, but optimum growth and survival are unlikely. Planting the trees and shrubs on the contour helps to control water erosion.

This soil is slightly limited as a site for dwellings and septic tank absorption fields. It is moderately limited as a site for hard-surfaced roads and streets because of low strength. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

The land capability classification is IVe-8, and the range site is Thin Upland. The windbreak suitability group is 8.

NcE—Nevee-Gullied land complex, 6 to 40 percent slopes. This map unit consists of a deep, well drained, moderately sloping to moderately steep Nevee soil intermingled with areas of moderately steep and steep Gullied land. It is on low terraces and in swales in the Red Valley. The Nevee soil formed in material

weathered from reddish siltstone, sandstone, and silty shale. It is on side slopes and ridges. The Gullied land is in eroding drainageways on foot slopes and toe slopes. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 1,200 acres in size. They are 55 to 65 percent Nevee soil and 30 to 40 percent Gullied land. The Nevee soil and Gullied land occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Nevee soil is yellowish red, calcareous silt loam about 8 inches thick. The underlying material to a depth of about 60 inches is firm, calcareous, reddish yellow silt loam and light red loam. In some areas the surface layer is darker. In other areas the depth to bedrock is 20 to 40 inches.

Typically, the areas of Gullied land are barren, actively eroding, V- and U-shaped drainageways that cut into the Nevee soils.

Included in this unit in mapping are small areas of Gypnevee and Spearfish soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. Gypnevee soils have more than 40 percent, by weight, carbonates plus gypsum. They are in landscape positions similar to those of the Nevee soil. Spearfish soils are shallow over bedrock. They are on high parts of the landscape. The Rock outcrop is reddish siltstone, sandstone, and shale. It is on high parts of the landscape.

Fertility and the content of organic matter are low in the Nevee soil. The available water capacity is high, and permeability is moderate. Runoff is rapid.

Most of the acreage supports native grasses and is used for grazing. Controlling water erosion and conserving moisture are management concerns. Proper stocking rates and rotation grazing help to maintain a good plant cover and ground mulch, which help to control water erosion, increase the rate of water intake, and conserve moisture.

This map unit generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. The many gullies that dissect the unit and the moderately sloping to steep slopes are the main limitations.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets because of the slope. Construction activities are hindered because of the numerous actively eroding gullies. Designing dwellings so that they conform to the natural slope of the land reduces the amount of land shaping needed to overcome the slope. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. Building roads and streets on the contour helps to overcome the slope. Diverting runoff, installing water bars and culverts, land shaping, and reseeding disturbed areas help to control erosion. Applying gravel to unsurfaced roads improves the traffic-supporting capacity during wet periods.

The land capability classification of the Nevee soil is VIe-3, the range site is Thin Upland, and the windbreak suitability group is 10. The land capability classification of the Gullied land is VIIIs-2; no range site or windbreak suitability group is assigned.

NfE—Nihill-Zigweid complex, 15 to 50 percent slopes. These deep, well drained, moderately steep to very steep soils are on upland ridges and on slope breaks of old terraces. They are in the Red Valley and at lower elevations on the Limestone Plateau. The Nihill soil formed in gravelly alluvium. It is on the upper side slopes and ridges. The Zigweid soil formed in calcareous, loamy sediments. It is on the lower side slopes. Elevation ranges from 3,200 to 5,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 1,000 acres in size. They are 40 to 50 percent Nihill soil and 30 to 40 percent Zigweid soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Nihill soil is grayish brown, calcareous gravelly loam about 3 inches thick. The subsurface layer is light brownish gray, friable, calcareous gravelly loam about 4 inches thick. The underlying material to a depth of about 60 inches is very pale brown, calcareous very gravelly loam. In some areas the underlying material is redder.

Typically, the surface layer of the Zigweid soil is brown clay loam about 2 inches thick. The subsurface layer is pale brown, calcareous clay loam about 2 inches thick. The subsoil is pale brown and light gray, friable, calcareous clay loam about 16 inches thick. The underlying material to a depth of about 60 inches is light gray, calcareous clay loam. In some areas the subsoil and underlying material have less clay. In other areas bedrock is at a depth of 20 to 40 inches.

Included with these soils in mapping are small areas of Sawdust and Spearfish soils. These included soils make up less than 10 percent of any one mapped area. They are in landscape positions similar to those of the

Nihill soil. Sawdust soils have limestone fragments throughout. Spearfish soils have reddish shale at a depth of 10 to 20 inches.

Fertility and the content of organic matter are low in the Nihill and Zigweid soils. The available water capacity is moderate in the Nihill soil and high in the Zigweid soil. Permeability is moderately rapid in the Nihill soil and moderate in the Zigweid soil. The shrink-swell potential is low in the Nihill soil and moderate in the Zigweid soil. Runoff is rapid on both soils.

Most of the acreage supports native grasses and is used for grazing. Some areas support sparse stands of ponderosa pine. These soils are well suited to livestock grazing on slopes of less than 30 percent. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Proper stocking rates and rotation grazing help to maintain maximum productivity.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets because of the slope. Designing buildings so that they conform to the natural slope of the land reduces the amount of land shaping needed to overcome the slope. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields function properly. Building roads and streets on the contour helps to overcome the slope. Diverting runoff, installing water bars and culverts, land shaping, and seeding disturbed areas help to control erosion.

The land capability classification is VIIe-1 for the Nihill soil and VIe-1 for the Zigweid soil. The range site is Thin Upland and the windbreak suitability group is 10 for both soils.

NnE—Norrest-Fairburn-Metre complex, 9 to 40 percent slopes. These well drained, strongly sloping to very hilly soils are on uplands in the Red Valley. They formed in material weathered from mudstone. The moderately deep Norrest soil is on side slopes. The shallow Fairburn soil is on ridges. The moderately deep Metre soil is on the lower side slopes and on foot slopes. Gilgai relief is common in areas of this soil. Elevation ranges from 3,200 to 5,000 feet above sea level. Annual precipitation ranges from 17 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to 2,000 acres in size. They are 45 to 55 percent Norrest soil, 15 to 25 percent Fairburn soil, and 10 to 20 percent Metre soil. The three soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Norrest soil is grayish brown cobbly silty clay loam about 4 inches thick. The subsoil is about 20 inches thick. It is brown and very pale brown, firm silty clay in the upper part and very pale brown, calcareous silty clay loam in the lower part. The underlying material is very pale brown, calcareous silty clay loam. Very pale brown, soft mudstone is at a depth of about 32 inches. In some areas the depth to bedrock is more than 40 inches. In other areas the subsoil has less clay.

Typically, the surface layer of the Fairburn soil is dark grayish brown cobbly silty clay loam about 3 inches thick. The next layer is brown, friable, calcareous silty clay loam about 5 inches thick. The underlying material is very pale brown, calcareous silty clay loam. Very pale brown, calcareous mudstone is at a depth of about 18 inches. In some areas the underlying material has less clay. In other areas the depth to bedrock is 20 to 40 inches.

Typically, the surface layer of the Metre soil is very dark grayish brown clay about 5 inches thick. The subsoil is very dark gray, dark gray, and reddish brown, very firm and extremely firm, calcareous clay about 31 inches thick. Reddish brown, soft mudstone is at a depth of about 36 inches. In some areas the subsoil is not so dark. In other areas the depth to bedrock is more than 40 inches.

Included with these soils in mapping are small areas of Hilger and Spearfish soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. The deep Hilger soils have rock fragments throughout. They are on the less sloping parts of the landscape. The shallow Spearfish soils formed in material weathered from red siltstone and shale. They are on steep parts of the landscape. The Rock outcrop is mudstone, red siltstone, shale, or sandstone. It is generally on high parts of the landscape. Also included are some areas where stones cover as much as 25 percent of the surface.

Fertility is medium in the Norrest and Metre soils and low in the Fairburn soil. The content of organic matter is moderate in the Norrest and Metre soils and low in the Fairburn soil. The available water capacity is low in all three soils. Permeability is moderately slow in the Norrest and Fairburn soils and very slow in the Metre soil. The shrink-swell potential is high in the Norrest soil, moderate in the Fairburn soil, and very high in the Metre soil. Runoff is medium on all three soils.

Most of the acreage supports native grasses and is used for grazing. Some areas support a few ponderosa pine. Erosion is a hazard. Maintaining an adequate ground cover helps to control erosion on the steeper parts of the landscape.

This unit generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. The main limitations are the cobbly surface layer of the Norrest and Fairburn soils and the slope.

These soils have severe limitations if used as sites for dwellings. The shrink-swell potential and the slope are the main limitations. Backfilling with sandy material, installing foundation drains, and diverting runoff away from buildings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Designing buildings so that they conform to the natural slope of the land reduces the amount of land shaping needed to overcome the slope. Land shaping is needed in some areas. The sides of shallow excavations in areas of the Metre soil can cave in unless they are shored.

These soils have severe limitations if used as sites for septic tank absorption fields. A thin layer of suitable material, seepage, and the slope are the main limitations. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water. Better suited sites generally are available.

These soils have severe limitations if used as sites for hard-surfaced roads and streets. The shrink-swell potential, low strength, and the slope are the main limitations. Constructing the roads on coarse textured, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by low strength and by shrinking and swelling. Building the roads and streets on the contour helps to overcome the slope. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification is VIe-5 for the Norrest soil, VIe-11 for the Fairburn soil, and VIe-4 for the Metre soil. The range site is Stony Hills for the Norrest and Fairburn soils and Clayey for the Metre soil. The windbreak suitability group is 10 for all three soils.

PaE—Pactola-Virkula-Rock outcrop complex, 10 to 40 percent slopes. This map unit consists of deep, well drained, strongly sloping to steep Pactola and Virkula soils intermingled with areas of Rock outcrop. It is on mountains in the Central Crystalline Area. The Pactola and Virkula soils formed in material weathered from steeply tilted metamorphic rock. The Pactola soil is on side slopes and ridges. The Virkula soil is on foot slopes. The areas of Rock outcrop generally are less than 10 acres in size and are on side slopes and ridges. Elevation ranges from 4,000 to 6,200 feet above sea level. Annual precipitation ranges from 18 to 22 inches.

Areas of this map unit are irregular in shape and are 10 to several thousand acres in size. They are 50 to 60 percent Pactola soil, 15 to 30 percent Virkula soil, and 10 to 20 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Pactola soil. The surface layer is dark gray channery loam about 1 inch thick. The subsurface layer is very pale brown channery loam about 10 inches thick. The next 7 inches is pale brown very channery clay loam and very pale brown channery loam. The subsoil is yellowish brown, firm extremely channery clay loam. Grayish brown, steeply tilted, fractured metamorphic rock is at a depth of about 42 inches. In some areas the depth to bedrock is 20 to 40 inches. In other areas the soil has more mica.

Typically, about 1 inch of forest litter is on the surface of the Virkula soil. The surface layer is grayish brown loam about 1 inch thick. The subsurface layer is light gray loam about 12 inches thick. The next 9 inches is pale brown silty clay loam and light gray loam. The subsoil is light yellowish brown, firm silty clay loam about 23 inches thick. The underlying material to a depth of about 60 inches is light yellowish brown channery and very channery silty clay loam. In some areas the depth to bedrock is 20 to 40 inches. In other areas the subsoil has 10 to 30 percent channers by volume.

The Rock outcrop is gray, hard, steeply tilted, fractured metamorphic rock. It occurs as low, slabby protrusions in some areas and as massive dikes or peaks in other areas.

Included in this unit in mapping are small areas of Cordeston, Heely, and Mocmont soils and soils that are less than 20 inches over bedrock. Included soils make up less than 20 percent of any one mapped area. Cordeston soils have a thick, dark surface layer. They are along drainageways. Heely and Mocmont soils are in landscape positions similar to those of the Pactola soil. Heely soils have a dark surface layer. Mocmont soils formed in material weathered from granite. The soils that are less than 20 inches over bedrock are generally adjacent to the Rock outcrop.

The available water capacity is low in the Pactola soil and high in the Virkula soil. Permeability is moderate in the Pactola soil and moderately slow in the Virkula soil.

The shrink-swell potential is moderate in both soils. Runoff is medium.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 60 on the Pactola soil and 72 on the Virkula soil. Some quaking aspen, paper birch, and Black Hills spruce grow on north aspects and along drainageways. Bur oak grows on the Virkula soil at low elevations in the eastern part of the survey area. The understory is dominantly little bluestem, sedges, prairie dropseed, western wheatgrass, needlegrass, snowberry, russet buffaloberry, chokecherry, and leadplant.

Some areas below the Rock outcrop have large boulders on the surface. These boulders interfere with felling and the use of skidding equipment and other equipment. When the Virkula soil is wet, logging activities, such as skidding, hauling, and construction, may cause surface compaction and the formation of ruts. These activities should be restricted to periods when the soil is dry or frozen. Erosion can be controlled by seeding disturbed areas and by installing water bars and culverts. Mass soil movement may occur on or above disturbed areas. Harvesting or thinning methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard on the Pactola soil.

This map unit is well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. Because of the slope, watering facilities should be located on low parts of the landscape.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets because of the slope. The Rock outcrop, the large stones in the Pactola soil, and the moderately slow permeability and low strength in the Virkula soil are additional limitations. Better suited sites generally are available.

The land capability classification of the Pactola soil is VIIe-9, and the grazable woodland group is Rocky Side Slopes. The land capability classification of the Virkula soil is VIe-13, and the grazable woodland group is Silty Foot Slopes. The land capability classification of the Rock outcrop is VIIIs-1; no grazable woodland group is assigned.

PbD—Paunsaugunt-Gurney complex, 2 to 15 percent slopes. These well drained, gently sloping to strongly sloping soils are on mountains and mountain prairies. They are at the lower elevations on the Limestone Plateau. They formed in material weathered from sedimentary rock. The shallow Paunsaugunt soil is on the upper side slopes and on ridges. The moderately deep Gurney soil is on foot slopes and the lower side slopes. Elevation ranges from 3,400 to 6,200 feet above sea level. Annual precipitation ranges from 16 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to 2,500 acres in size. They are 45 to 55 percent Paunsaugunt soil and 25 to 35 percent Gurney soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Paunsaugunt soil is dark brown, calcareous gravelly loam about 2 inches thick. The subsurface layer is brown, calcareous gravelly loam about 4 inches thick. The underlying material is brown, calcareous very gravelly loam. Light brown limestone is at a depth of about 11 inches. In places the bedrock is at a depth of less than 10 inches.

Typically, the surface layer of the Gurney soil is dark brown loam about 5 inches thick. The subsoil is about 23 inches thick. It is brown, very friable loam in the upper part; light yellowish brown, friable clay loam in the next part; and yellowish brown, calcareous clay loam and channery clay loam in the lower part. Red, indurated sandstone is at a depth of about 28 inches. In some places, the subsoil is thicker and the depth to bedrock is more than 40 inches. In other places the subsoil has less sand and more silt.

Included with these soils in mapping are small areas of Hilger, Sawdust, and Zigweid soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. The deep Hilger and Sawdust soils have coarse fragments throughout. Hilger soils are on high parts of the landscape. Sawdust soils are on side slopes in forested areas. The deep Zigweid soils are calcareous throughout. They are on mid parts of the landscape. The areas of Rock outcrop are on high parts of the landscape.

Fertility is medium in the Paunsaugunt soil and high in the Gurney soil. The content of organic matter is moderate in the Paunsaugunt soil and high in the Gurney soil. The available water capacity is very low in the Paunsaugunt soil and low in the Gurney soil. Permeability is moderate in both soils. The shrink-swell potential is low in the Paunsaugunt soil. It is moderate in the subsoil of the Gurney soil and low in the underlying material. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used for grazing. Some areas of the Paunsaugunt soil, especially those in the southwestern part of the survey area, support skunkbush sumac and

mountainmahogany. Generally, no major hazards or limitations affect the use of these soils for range, but conserving moisture is a management concern. Proper stocking rates and rotation grazing help to maintain maximum productivity.

This map unit generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings because of the shallowness to bedrock in the Paunsaugunt soil. Small areas of the Gurney soil are suited to tame pasture and hay and to windbreaks and environmental plantings. Intermediate wheatgrass, green needlegrass, and smooth brome are examples of suitable pasture plants. No trees or shrubs grow well on the Gurney soil. They can be established, but optimum growth and survival rates are unlikely.

These soils are severely limited as sites for dwellings with basements and for hard-surfaced roads and streets. The Gurney soil is moderately limited as a site for dwellings without basements. The depth to bedrock in the Paunsaugunt and Gurney soils and low strength in the Gurney soil are the main limitations. Construction activities are hindered on these soils because of the depth to bedrock. Building roads and streets on coarse grained subgrade or base material helps to prevent the damage caused by low strength. Unsurfaced roads in areas of the Paunsaugunt soil may require additions of borrow material. Applying gravel to these roads improves the traffic-supporting capacity during wet periods.

These soils are severely limited as sites for septic tank absorption fields. A thin layer of suitable material and seepage are the main limitations. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water. Better suited sites generally are available.

The land capability classification of the Paunsaugunt soil is VIIs-1, the range site is Shallow, and the windbreak suitability group is 10. The land capability classification of the Gurney soil is IVs-4, the range site is Silty, and the windbreak suitability group is 6R.

PcD—Paunsaugunt-Rock outcrop complex, 6 to 30 percent slopes. This map unit consists of a shallow, well drained, moderately sloping to steep Paunsaugunt soil intermingled with areas of Rock outcrop. It is on mountains at the lower elevations on the Limestone Plateau. The Paunsaugunt soil formed in material weathered from limestone and calcareous sandstone. The areas of Rock outcrop generally are less than 1 acre in size. Elevation ranges from 3,400 to 5,400 feet above sea level. Annual precipitation ranges from 18 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to 1,500 acres in size. They are 45 to 55 percent Paunsaugunt soil and 30 to 40 percent Rock outcrop. The Paunsaugunt soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Paunsaugunt soil is dark brown, calcareous gravelly loam about 2 inches thick. The subsurface layer is brown, calcareous gravelly loam about 4 inches thick. The underlying material is brown, calcareous very gravelly loam. Light brown limestone is at a depth of about 11 inches. In some areas the depth to bedrock is 20 to 40 inches or is less than 10 inches.

The Rock outcrop generally is light brown and pink limestone. In some areas in the southern part of the survey area, however, it is calcareous sandstone. It occurs as ledges and small, low-relief protrusions.

Included in this unit in mapping are small areas of Sawdust and Tilford soils and soils that have bedrock at a depth of 20 to 40 inches. Included soils make up less than 15 percent of any one mapped area. They are in landscape positions similar to those of the Paunsaugunt soil. The deep Sawdust soils have coarse fragments throughout. The deep Tilford soils formed in material weathered from reddish siltstone or shale.

The available water capacity is very low in the Paunsaugunt soil. Permeability is moderate. Runoff is medium.

Most of the acreage is used for timber. The timber canopy generally is sparse. The overstory is dominantly stunted ponderosa pine. This map unit has a limited potential for timber. The site index for ponderosa pine is about 45. The understory is dominantly little bluestem, sideoats grama, sedges, snowberry, chokecherry, and skunkbush sumac. The dominant shrub in the southwestern part of the survey area is mountainmahogany.

Water erosion and windthrow are management concerns in timbered areas. Erosion can be controlled by seeding disturbed areas and by installing water bars and culverts. The windthrow hazard is severe on the Paunsaugunt soil. It can be reduced by thinning and harvesting methods that do not isolate the remaining trees or leave them widely spaced.

This map unit is suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. The number of suitable sites for watering facilities is limited.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-

surfaced roads and streets. A thin layer of suitable material and seepage in the Paunsaugunt soil, the Rock outcrop, and the slope are the main limitations. Better suited sites generally are available. Unsurfaced roads may require additions of borrow material. Applying gravel to these roads improves the traffic-supporting capacity during wet periods.

The land capability classification of the Paunsaugunt soil is VIIs-1, and the grazable woodland group is Shallow Ridge. The land capability classification of the Rock outcrop is VIIIs-1; no grazable woodland group is assigned.

PgC—Pierre-Grummit clays, 2 to 9 percent slopes. These well drained, gently sloping and moderately sloping soils are on uplands in the southwest part of the survey area. The moderately deep Pierre soil formed in clayey material weathered from shale. It generally is on the lower side slopes. The shallow Grummit soil formed in clayey material weathered from acid shale. It is on ridges. Elevation ranges from 3,500 to 4,000 feet above sea level. Annual precipitation ranges from 14 to 16 inches.

Areas of this map unit are irregular in shape and are 40 to 500 acres in size. They are 45 to 55 percent Pierre soil and 30 to 40 percent Grummit soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Pierre soil is brown, calcareous clay about 4 inches thick. The subsoil is grayish brown, firm, calcareous clay about 20 inches thick. The underlying material is grayish brown, calcareous clay. It has about 50 percent shale fragments in the lower part. Gray shale is at a depth of about 32 inches. In some areas the soil has less clay. In other areas the depth to shale is more than 40 inches.

Typically, the surface layer of the Grummit soil is gray clay about 4 inches thick. The underlying material is gray clay about 12 inches thick. Shale fragments increase in size and number with increasing depth. Dark gray, soft, acid shale is at a depth of about 16 inches. In some areas the surface layer has as much as 50 percent gravel and small cobbles.

Included with these soils in mapping are small areas of Arvada, Demar, and Nihill soils. These included soils make up less than 15 percent of any one mapped area. Arvada and Demar soils have a sodium affected subsoil. They are on low parts of the landscape. Nihill soils are gravelly throughout. They are on ridges.

Fertility is medium in the Pierre soil and low in the Grummit soil. The content of organic matter is moderate in the Pierre soil and low in the Grummit soil. The available water capacity is low in the Pierre soil and very low in the Grummit soil. Permeability is very slow in the Pierre soil and moderately slow in the Grummit soil. The shrink-swell potential is very high in the Pierre soil and high in the Grummit soil. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used for grazing. Some areas of the Grummit soil have an overstory of stunted ponderosa pine. Water erosion is a hazard unless an adequate plant cover is maintained. Proper stocking rates and rotation grazing help to maintain maximum productivity.

This map unit is poorly suited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and western wheatgrass are examples of suitable pasture plants in areas of the Pierre soil. Small grain is the main crop. No pasture plants or crops grow well on the Grummit soil. Conserving moisture, controlling water erosion, and improving tilth are management concerns. Leaving crop residue on the surface and minimizing tillage conserve moisture. Including grasses and legumes in the cropping system helps to control water erosion and improves tilth.

The Pierre soil is suited to windbreaks and environmental plantings, but the Grummit soil generally is unsuited. The clayey subsoil of the Pierre soil restricts the penetration of plant roots. Optimum growth and survival rates are unlikely. Planting on the contour helps to control erosion.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The shrink-swell potential, low strength, a thin layer of suitable material, and seepage are the main limitations. The sides of shallow excavations in areas of the Pierre soil can cave in unless they are shored. Backfilling with sandy material, installing foundation drains, and diverting runoff away from dwellings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Septic tank absorption fields do not function well on these soils because of a thin layer of suitable material and seepage. Unconventional septic systems may be needed. Constructing roads on coarse textured, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by low strength and by shrinking and swelling. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Pierre soil is

IVe-1, the range site is Clayey, and the windbreak suitability group is 4C. The land capability classification of the Grummit soil is VIe-12, the range site is Shallow Clay, and the windbreak suitability group is 10.

Pt—Pits, quarries. These areas are open excavations from which rock, gravel, or sand has been removed. Slopes are uneven and broken. They are nearly level on the pit bottoms and almost vertical on the sidewalls. Some pit bottoms are covered with water. Areas are irregular in shape and are 5 to 550 acres in size.

Most of the large pits are active quarries where limestone is mined for use in the manufacture of portland cement or quicklime. Many of the small pits that were excavated for feldspar, gold, or other minerals have been abandoned. Some small quarries are mined only when additional road material is needed. Mounds of mixed, loamy overburden are on the edges of the excavations.

Revegetation of the pits is naturally slow. Abandoned pits can be restored to range or tame pasture if reclamation measures are applied. These measures include shaping the areas and topdressing with overburden material. Applying fertilizer as needed helps to establish range and pasture plants.

The land capability classification is VIIIs-2; no range site or windbreak suitability group is assigned.

ReC—Redbird-Heath silt loams, 2 to 9 percent slopes. These deep, well drained, gently sloping and moderately sloping soils are in mountain valley meadows at the higher elevations on the Limestone Plateau. They are dissected by intermittent drainageways. They formed in material weathered from limestone and calcareous sandstone. The rarely flooded Redbird soil is on low parts of the landscape. The Heath soil is on high parts of the landscape. Elevation ranges from 6,200 to 7,000 feet above sea level. Annual precipitation ranges from 20 to 24 inches.

Areas of this map unit are long and narrow and are 10 to 750 acres in size. They are 45 to 55 percent Redbird soil and 25 to 35 percent Heath soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Redbird soil is dark grayish brown silt loam about 7 inches thick. The subsoil is dark grayish brown, very dark grayish brown, and grayish brown, firm and friable very cobbly and extremely cobbly silty clay loam about 17 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is pale brown, calcareous extremely cobbly loam. In some areas the subsoil is not so dark. In other areas it has less clay.

Typically, the surface layer of the Heath soil is dark grayish brown silt loam about 7 inches thick. The next layer is brown silty clay loam about 5 inches thick. The subsoil is about 30 inches thick. It is brown, firm silty clay loam in the upper part; brown silty clay in the next part; and light brown, calcareous silty clay loam in the lower part. The underlying material to a depth of about 60 inches is light brown, calcareous clay loam. In some areas the depth to bedrock is 20 to 40 inches. In other areas the subsoil has less clay.

Included with these soils in mapping are small areas of Stovho and Trebor soils, a very poorly drained soil, and areas of Rock outcrop. Inclusions make up less than 20 percent of any one mapped area. The very poorly drained soil is in areas below springs and has a seasonal high water table at or near the surface. Stovho and Trebor soils have a light colored surface layer. They are in the forested areas. The Rock outcrop is on high parts of the landscape.

Fertility and the content of organic matter are high in the Redbird and Heath soils. The available water capacity is moderate in the Redbird soil and high in the Heath soil. Permeability is moderate in the Redbird soil and slow in the Heath soil. The shrink-swell potential is moderate in the subsoil of the Redbird soil and low in the underlying material. It is high in the subsoil of the Heath soil and moderate in the underlying material. Runoff is slow or medium on both soils.

Most of the acreage supports native grasses and is used for grazing. Some areas of the Redbird soil support quaking aspen, ponderosa pine, and Black Hills spruce. A cold soil temperature limits plant growth. Delaying grazing until the soils have warmed and the forage species have achieved sufficient growth helps to prevent depletion of the desirable forage species.

These soils generally are unsuited to cultivated crops and to windbreaks and environmental plantings because of a short growing season. The Heath soil is suited to tame pasture and hay, but the Redbird soil generally is unsuited. Alsike clover, bearded wheatgrass, and mountain brome are examples of suitable pasture plants.

These soils are severely limited as sites for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The large stones in the Redbird soil and the high shrink-swell potential, low strength, and the slow permeability in the Heath soil are the main limitations. Flooding is a hazard on the Redbird soil. As a result, the Heath soil is a better site for dwellings. Excavations in the Redbird soil are

hindered by the numerous large rock fragments. Diverting runoff away from the dwellings and reinforcing foundations and footings help to prevent the structural damage caused by shrinking and swelling of the Heath soil. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

Constructing roads on coarse textured, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by low strength and by shrinking and swelling in the Heath soil. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Redbird soil is VIs-4, and the range site is High Country Overflow. The land capability classification of the Heath soil is VIe-13, and the range site is High Country Silty. The windbreak suitability group is 10 for both soils.

RfE—Rekop-Gypnevee-Rock outcrop complex, 15 to 40 percent slopes. This map unit consists of moderately steep and steep Rekop and Gypnevee soils intermingled with areas of Rock outcrop. It is on uplands in the Red Valley. The Rekop and Gypnevee soils formed in material weathered from gypsum and reddish, gypsiferous siltstone. The shallow, somewhat excessively drained Rekop soil is on the upper side slopes and on ridges. The deep, well drained Gypnevee soil is on lower side slopes and on foot slopes. The areas of Rock outcrop generally are on ridges and the upper side slopes and are barren. Most are less than 3 acres in size. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 1,000 acres in size. They are 35 to 45 percent Rekop soil, 25 to 35 percent Gypnevee soil, and 10 to 20 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Rekop soil is reddish brown, calcareous loam about 4 inches thick. The underlying material is light reddish brown and pink, very friable, calcareous loam. White gypsum is at a depth of about 12 inches.

Typically, the surface layer of the Gypnevee soil is reddish brown, calcareous silt loam about 8 inches thick. The next layer is red, friable, calcareous silt loam about 10 inches thick. The underlying material is light red and red, calcareous loam. Light red, gypsiferous siltstone and gypsum are at a depth of about 41 inches. In some areas the depth to bedrock is 20 to 40 inches.

The Rock outcrop is pinkish white and white gypsum and alabaster. It occurs as domes on the less sloping parts of the landscape and as ledges on the steep parts.

Included in this unit in mapping are small areas of Nevee, Spearfish, and Tilford soils. Also included are small areas where scattered large sandstone boulders are on the surface. These areas are adjacent to the Dakota Hogback. Included soils make up less than 15 percent of any one mapped area. They contain less gypsum than the Rekop and Gypnevee soils. Nevee and Tilford soils are on low parts of the landscape. Spearfish soils have bedrock within a depth of 20 inches. They are in landscape positions similar to those of the Rekop soil. Sinkholes are in some included areas.

Fertility and the content of organic matter are low in the Rekop and Gypnevee soil. The available water capacity is very low in the Rekop soil and moderate in the Gypnevee soil. Permeability is moderate in both soils. Runoff is medium or rapid.

Most of the acreage supports native grasses and is used for grazing. Some areas support a sparse overstory of ponderosa pine. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas.

This map unit generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings because of the slope.

Rekop and Gypnevee soils are severely limited as sites for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The slope, a thin layer of suitable material, and a hazard of seepage in the Rekop soil are the main limitations. Because of the content of soluble gypsum, dwellings and roads may settle unevenly or fail. Both soils are highly corrosive to concrete and uncoated steel. Better suited sites generally are available. Unsurfaced roads in areas of the Rekop soil may require additions of borrow material. Applying gravel to these roads improves the traffic-supporting capacity during wet periods.

The land capability classification of the Rekop soil is VIIe-4, the range site is Shallow, and the windbreak suitability group is 10. The land capability classification of the Gypnevee soil is VIe-3, the range site is Thin Upland, and the windbreak suitability group is 10. The land capability classification of the Rock outcrop is VIIIs-1; no range site or windbreak suitability group is assigned.

RgG—Rock outcrop-Buska complex, 40 to 80 percent slopes. This map unit consists of Rock outcrop intermingled with a deep, well drained, very steep Buska soil. It is on the sides of mountain valleys and canyons in the Central Crystalline Area. The Rock outcrop is on the mid and high parts of the landscape. The Buska soil formed in loamy material weathered from micaceous schist. It is on the lower side slopes. Elevation ranges from 4,500 to 6,200 feet above sea level. Annual precipitation ranges from 16 to 22 inches.

Areas of this map unit are irregular in shape and are 15 to 1,000 acres in size. They are 40 to 50 percent Rock outcrop and 35 to 45 percent Buska soil. The Rock outcrop and the Buska soil occur as areas so closely intermingled or so small that mapping them separately was not practical.

The Rock outcrop is gray, fractured schist and massive dikes of granite. It occurs as low-relief protrusions or large ledges. Most of the schist outcrops have vertically oriented bedding planes.

Typically, about 1 inch of forest litter is on the surface of the Buska soil. The surface layer is very dark gray loam about 1 inch thick. The subsurface layer is pale brown loam about 11 inches thick. The next layer is brown and yellowish brown channery loam about 3 inches thick. The subsoil is yellowish brown, friable very channery loam about 10 inches thick. The underlying material is light yellowish brown very channery loam about 16 inches thick. Yellowish brown, micaceous schist is at a depth of about 41 inches. In some areas the bedrock is at a depth of 20 to 40 inches. In other areas the soil has less mica.

Included in this unit in mapping are small areas of Cordeston and Mocmont soils and soils that are less than 20 inches deep over bedrock. Included soils make up less than 15 percent of any one mapped area. Cordeston soils have a thick, dark surface layer. They are in meadows. Mocmont soils formed in material weathered from granite. They are in landscape positions similar to those of the Buska soil. The soils that are less than 20 inches deep over bedrock are generally adjacent to the Rock outcrop.

The available water capacity is low in the Buska soil. Permeability is moderate. Runoff is rapid.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 65 on the Buska soil. Some quaking aspen, paper birch, and Black Hills spruce grow on north aspects and along drainageways. The understory is dominantly little bluestem, sedges, prairie dropseed, snowberry, leadplant, chokecherry, and russet buffaloberry.

The Rock outcrop, very steep slopes, and boulders restrict the use of wheeled and tracked logging equipment. When timber is harvested, a cable logging system helps to overcome the slope and control water erosion. The erosion hazard can be reduced by seeding disturbed areas, installing water bars on skid trails, and providing culverts and rolling dips on sites for roads. Mass soil movement may occur on or above disturbed areas. Harvesting or thinning methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard on the Buska soil.

This map unit is suited to the production of forage for big game animals. It is poorly suited to livestock grazing because of the slope.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The Rock outcrop and very steep slopes are the main limitations. Better suited sites generally are available. Building roads on the contour helps to overcome the slope. Applying gravel to unsurfaced roads improves the traffic-supporting capacity during wet periods.

The land capability classification is VIIIs-1 for the Rock outcrop and VIIe-9 for the Buska soil. No grazable woodland group is assigned.

RhD—Rock outcrop-Butche complex, 2 to 25 percent slopes. This map unit consists of Rock outcrop intermingled with a shallow, excessively drained, gently sloping to moderately steep Butche soil. It is on mountain side slopes and ridges on the Dakota Hogback and at the lower elevations on the Limestone Plateau. The areas of Rock outcrop generally are less than 3 acres in size. The Butche soil formed in material weathered from sandstone. It is on side slopes. Elevation ranges from 3,200 to 5,500 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this unit are irregular in shape and are 10 to 400 acres in size. They are 50 to 60 percent Rock outcrop and 25 to 35 percent Butche soil. The Rock outcrop and the Butche soil occur as areas so closely intermingled or so small that mapping them separately was not practical.

The Rock outcrop is light gray, very pale brown, yellowish brown, and reddish brown, hard sandstone. It occurs as low-relief slabs of sandstone that are parallel to the surface.

Typically, the surface layer of the Butche soil is dark grayish brown cobbly loam about 4 inches thick. The underlying material is pale brown, very friable cobbly loam about 6 inches thick. Very pale brown, hard

sandstone is at a depth of about 10 inches. In some areas the bedrock is calcareous shale and weakly cemented sandstone. In other areas the soil has a higher content of sand.

Included in this unit in mapping are small areas of the moderately deep Gurney soils and the deep Lakoa and Rockoa soils. Included soils make up less than 15 percent of any one mapped area. They are on low parts of the landscape.

The available water capacity is very low in the Butche soil. Permeability is moderate. Runoff is medium.

Most of the acreage is used for timber. The canopy generally is sparse. The overstory is dominantly stunted ponderosa pine. The shallow Butche soil and the Rock outcrop have a limited potential for timber production. The site index for ponderosa pine is about 35. The understory is dominantly little bluestem, sideoats grama, prairie sandreed, mountainmahogany, leadplant, and skunkbush sumac. Harvesting and thinning methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard.

This unit is suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. The number of suitable sites for watering facilities is limited.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. It is poorly suited to unsurfaced roads. The Rock outcrop and the shallowness to bedrock in the Butche soil are the main limitations. Better suited sites generally are available.

The land capability classification of the Rock outcrop is VIIIs-1; no grazable woodland group is assigned. The land capability classification of the Butche soil is VIs-1, and the grazable woodland group is Shallow Ridge.

RkG—Rock outcrop-Mocmont complex, 40 to 80 percent slopes. This map unit consists of Rock outcrop intermingled with a deep, well drained, very steep Mocmont soil. It is on the sides of mountain peaks and canyons in the Central Crystalline Area. Slopes generally are short and broken by Rock outcrop. The Mocmont soil formed in material weathered from granitic rock. Elevation ranges from 5,600 to 7,200 feet above sea level. Annual precipitation ranges from 18 to 20 inches.

Areas of this map unit are irregular in shape and are 15 to several thousand acres in size. They are 40 to 50 percent Rock outcrop and 35 to 45 percent Mocmont soil. The Rock outcrop and the Mocmont soil occur as areas so closely intermingled or so small that mapping them separately was not practical.

The Rock outcrop is gray, granitic rock. It occurs as narrow spires or massive domes.

Typically, about 1 inch of forest litter is on the surface of the Mocmont soil. The surface layer is dark grayish brown gravelly loam about 2 inches thick. The subsurface layer is very pale brown gravelly loam about 10 inches thick. The next 6 inches is light yellowish brown very gravelly clay loam and very pale brown very gravelly loam. The subsoil is light yellowish brown, friable and firm very gravelly clay loam about 32 inches thick. The underlying material to a depth of about 60 inches is light yellowish brown extremely gravelly loam. In some areas the subsoil is more red. In other areas the depth to bedrock is 30 to 60 inches.

Included in this unit in mapping are small areas of Buska, Cordeston, and Pactola soils and soils that are less than 20 inches deep over bedrock. Included soils make up less than 20 percent of any one mapped area. Buska soils have more mica in the subsoil than the Mocmont soil. They are in landscape positions similar to those of the Mocmont soil. Cordeston soils have a thick, dark surface layer. They are along drainageways. Pactola soils formed in material weathered from metamorphic rock. They are in landscape positions similar to those of the Mocmont soil. The soils that are less than 20 inches deep over bedrock are generally adjacent to the Rock outcrop.

The available water capacity is low in the Mocmont soil, and permeability is moderate. The shrink-swell potential is moderate in the subsoil and low in the underlying material. Runoff is rapid.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 60 on the Mocmont soil. This soil supports some quaking aspen, paper birch, and bur oak. The understory is dominantly little bluestem, sedges, needlegrass, leadplant, snowberry, and bearberry.

The Rock outcrop, the slope, and boulders restrict the use of wheeled and tracked logging equipment. When timber is harvested, a cable logging system helps to overcome the slope and control erosion. The erosion hazard can be reduced by reseeding disturbed areas, installing water bars on skid trails, and providing culverts and rolling dips on sites for roads. Mass soil movement may occur in or above disturbed areas.

This map unit is suited to the production of forage for big game animals. It is poorly suited to livestock grazing because of the slope.

This map unit is severely limited as a site for

dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The slope and the Rock outcrop are the main limitations. Better suited sites generally are available. Building unsurfaced roads on the contour helps to overcome the slope and control water erosion. Applying gravel to these roads improves the traffic-supporting capacity during wet periods.

The land capability classification is VIIIs-1 for the Rock outcrop and VIIe-9 for the Mocmont soil. No grazable woodland group is assigned.

RlG—Rock outcrop-Pactola complex, 40 to 80 percent slopes. This map unit consists of Rock outcrop intermingled with a deep, well drained, very steep Pactola soil. It is on mountains and canyons in the Central Crystalline Area. The areas of Rock outcrop are generally less than 10 acres in size. They are on side slopes and ridges. The Pactola soil formed in material weathered from steeply tilted metamorphic rock. It is on foot slopes and side slopes. Elevation ranges from 4,000 to 6,200 feet above sea level. Annual precipitation ranges from 18 to 20 inches.

Areas of this map unit are irregular in shape and are 80 to several hundred acres in size. They are 40 to 50 percent Rock outcrop and 35 to 45 percent Pactola soil. The Rock outcrop and Pactola soil occur as areas so closely intermingled or so small that mapping them separately was not practical.

The Rock outcrop is gray, fractured, steeply tilted metamorphic rock. It occurs as massive boulders and dikes. In many areas weathering has caused rock slides below the Rock outcrop.

Typically, about 1 inch of forest litter is on the surface of the Pactola soil. The surface layer is dark gray channery loam about 1 inch thick. The subsurface layer is very pale brown channery loam about 10 inches thick. The next 7 inches is pale brown very channery clay loam and very pale brown channery loam. The subsoil is yellowish brown, firm extremely channery clay loam. Grayish brown, steeply tilted, fractured metamorphic rock is at a depth of about 42 inches. In some areas the depth to bedrock is 20 to 40 inches. In other areas the soil has more mica.

Included in this unit in mapping are small areas of Cordeston, Mocmont, and Virkula soils and soils that are less than 20 inches deep over bedrock. Included soils make up less than 20 percent of any one mapped area. Cordeston soils have less clay than the Pactola soil. They are in meadows. Mocmont soils formed in material weathered from granite. They are in landscape positions similar to those of the Pactola soil. Virkula soils have fewer coarse fragments than the Pactola soil. They are along timbered drainageways. The soils that are less than 20 inches deep over bedrock are generally adjacent to the Rock outcrop.

The available water capacity is low in the Pactola soil. Permeability is moderate. The shrink-swell potential also is moderate. Runoff is medium or rapid.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 55 on the Pactola soil. Some quaking aspen, paper birch, and Black Hills spruce grow on north aspects and along drainageways. The understory is dominantly little bluestem, sedges, prairie dropseed, russet buffaloberry, snowberry, chokecherry, and leadplant.

The Rock outcrop, the slope, and boulders restrict the use of wheeled and tracked logging equipment. When timber is harvested, a cable logging system helps to overcome the slope and control water erosion. Erosion also can be controlled by reseeding disturbed areas, installing water bars on skid trails, and providing culverts and rolling dips on sites for roads. Mass soil movement may occur in disturbed areas. Harvesting and thinning methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard on the Pactola soil.

This map unit is suited to the production of forage for big game animals. It is poorly suited to livestock grazing because of the slope.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The Rock outcrop and the slope are the main limitations. Better suited sites generally are available. Building unsurfaced roads on the contour helps to overcome the slope. Applying gravel to these roads improves the traffic-supporting capacity during wet periods.

The land capability classification is VIIIs-1 for the Rock outcrop and VIIe-9 for the Pactola soil. No grazable woodland group is assigned.

RmG—Rock outcrop-Rekop complex, 40 to 80 percent slopes. This map unit consists of Rock outcrop and a shallow, somewhat excessively drained, very steep Rekop soil. It is on uplands in the Red Valley. The areas of Rock outcrop are generally less than 3 acres in size. They are on the upper side slopes and on ridges. The Rekop soil is on the lower side slopes. It formed in material weathered from gypsum and reddish, gypsiferous siltstone. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are

10 to 500 acres in size. They are 40 to 50 percent Rock outcrop and 35 to 45 percent Rekop soil. The Rock outcrop and the Rekop soil occur as areas so closely intermingled or so small that mapping them separately was not practical.

The Rock outcrop generally occurs as ledges of pinkish white and white gypsum and alabaster. In places it occurs as very steep, barren areas of reddish, gypsiferous siltstone, sandstone, and shale.

Typically, the surface layer of the Rekop soil is reddish brown, calcareous loam about 4 inches thick. The underlying material is light reddish brown and pink, very friable, calcareous loam. White gypsum is at a depth of about 12 inches. In some areas the bedrock is at a depth of 20 to 40 inches.

Included in this unit in mapping are small areas of Gypnevee, Nevee, and Spearfish soils. These soils make up less than 15 percent of any one mapped area. The deep Gypnevee and Nevee soils are on low parts of the landscape. The shallow Spearfish soils do not have large amounts of gypsum. They are in landscape positions similar to those of the Rekop soil. Sinkholes are in some included areas.

Fertility and the content of organic matter are low in the Rekop soil. The available water capacity is very low. Permeability is moderate. Runoff is rapid.

This map unit generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. The Rock outcrop, the shallowness to bedrock, and the very steep slopes are the main limitations.

Most of the acreage supports native grasses and is used for grazing by big game animals. Livestock grazing is restricted because of the very steep slopes. Some areas support a sparse overstory of ponderosa pine. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The Rock outcrop, the very steep slopes, and a thin layer of suitable material and seepage in the Rekop soil are the main limitations. Better suited sites generally are available.

The land capability classification of the Rock outcrop is VIIIs-1; no range site or windbreak suitability group is assigned. The land capability classification of the Rekop soil is VIIe-4, the range site is Shallow, and the windbreak suitability group is 10.

RnG—Rock outcrop-Sawdust complex, 40 to 80 percent slopes. This map unit consists of Rock outcrop and a deep, well drained, very steep Sawdust soil. It is on mountains and in canyons at the lower elevations on the Limestone Plateau. The areas of Rock outcrop are generally less than 5 acres in size. They occur as continuous ledges on ridges and the upper side slopes. The Sawdust soil is on the lower side slopes and on foot slopes. It formed in material weathered from limestone and calcareous sandstone. Elevation ranges from 3,000 to 6,200 feet above sea level. Annual precipitation ranges from 16 to 20 inches.

Areas of this map unit are long and narrow and are 10 to 1,500 acres in size. They are 40 to 50 percent Rock outcrop and 35 to 45 percent Sawdust soil. The Rock outcrop and the Sawdust soil occur as areas so closely intermingled or so small that mapping them separately was not practical.

The Rock outcrop is pale brown, hard, fractured limestone and reddish and yellowish, hard, calcareous sandstone. It generally occurs as rimrock ledges. In some areas weathering has caused rock slides below the Rock outcrop.

Typically, the surface layer of the Sawdust soil is dark grayish brown, calcareous channery loam about 4 inches thick. The next layer is pale brown, friable, calcareous very channery loam about 4 inches thick. The upper part of the underlying material is light yellowish brown, calcareous very channery loam. The next part is very pale brown, calcareous extremely channery loam. The lower part to a depth of about 60 inches is yellow, calcareous extremely channery sandy loam. In some areas the soil has more sand. In other areas the depth to bedrock is 20 to 40 inches.

Included in this unit in mapping are small areas of Paunsaugunt, Vanocker, and Winetti soils. These soils make up less than 15 percent of any one mapped area. The shallow Paunsaugunt soils are in scattered areas throughout the map unit. Vanocker soils have more clay in the subsoil than the Sawdust soil. They are on north-facing slopes. Winetti soils formed in alluvium and are along drainageways.

The available water capacity is moderate in the Sawdust soil. Permeability also is moderate. Runoff is rapid.

Most of the acreage is used for timber. The canopy generally is sparse. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 45 on the Sawdust soil. The understory is dominantly little bluestem, sideoats grama, sedges, big bluestem, common juniper, snowberry, and yucca. Some mountainmahogany grows in areas of this unit in Hell Canyon and Redbird Canyon.

The Rock outcrop, the slope, and boulders restrict

the use of wheeled and tracked logging equipment. When timber is harvested, a cable logging system helps to overcome the slope and control water erosion. The erosion hazard can be reduced by reseeding disturbed areas, installing water bars on skid trails, and providing culverts and rolling dips on sites for roads. Mass soil movement may occur in disturbed areas.

This map unit is suited to the production of forage for big game animals. It is poorly suited to livestock grazing because of the slope.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The Rock outcrop and the slope are the main limitations. Better suited sites generally are available. Building unsurfaced roads on the contour helps to overcome the slope. Applying gravel to these roads improves the traffic-supporting capacity during wet periods.

The land capability classification is VIIIs-1 for the Rock outcrop and VIIe-9 for the Sawdust soil. No grazable woodland group is assigned.

RpC—Rockoa-Lakoa complex, 3 to 12 percent slopes. These deep, well drained, gently sloping to strongly sloping soils are on narrow ridgetops and smooth mountain side slopes on the Dakota Hogback. These soils formed in material weathered from interbedded sandstone and shale. Elevation ranges from 3,500 to 6,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 100 acres in size. They are 45 to 55 percent Rockoa soil and 30 to 40 percent Lakoa soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Rockoa soil. The surface layer is dark grayish brown and light brownish gray cobbly fine sandy loam about 6 inches thick. The next 3 inches is light brown very cobbly clay loam and light brownish gray cobbly fine sandy loam. The subsoil is light brown, pink, and pinkish gray, friable and firm very cobbly clay loam about 17 inches thick. The underlying material to a depth of about 60 inches is pinkish white extremely cobbly fine sandy loam. In some areas the depth to bedrock is 30 to 60 inches. In other areas the subsoil has more sand and less clay.

Typically, about 1 inch of forest litter is on the surface of the Lakoa soil. The surface layer is gray very fine sandy loam about 5 inches thick. The next 6 inches is yellowish brown clay loam and pale brown sandy loam. The subsoil is yellowish brown, light yellowish brown, and pale brown, firm and friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is very pale, calcareous gravelly clay loam. In some areas it is redder. In other areas it has more silt and less sand.

Included with these soils in mapping are small areas of Butche and Vanocker soils and areas of Rock outcrop. Inclusions make up less than 20 percent of any one mapped area. Butche soils have bedrock at a depth of 10 to 20 inches and are adjacent to the Rock outcrop. Vanocker soils have a surface layer and subsoil that are thinner than those of the Rockoa and Lakoa soils. They are in scattered areas throughout the unit. The areas of Rock outcrop are on high parts of the landscape.

The available water capacity is moderate in the Rockoa soil and high in the Lakoa soil. Permeability is moderate in both soils. The shrink-swell potential is low in the Rockoa soil and moderate in the Lakoa soil. Runoff is medium.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 55 on the Rockoa soil and 65 on the Lakoa soil. The Lakoa soil supports some bur oak, quaking aspen, hophornbeam, and paper birch. The understory is little bluestem, brome, sedges, oatgrass, snowberry, rose, Saskatoon serviceberry, and russet buffaloberry. When the Lakoa soil is wet, logging activities, such as skidding, hauling, and construction, may cause surface compaction and the formation of ruts. These activities should be restricted to periods when the soil is dry or frozen.

This map unit is well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. Because of seepage and the slope, watering facilities should be located on the less sloping parts of the landscape.

The Rockoa soil has severe limitations and the Lakoa soil moderate limitations if used as a site for dwellings or septic tank absorption fields. The shrink-swell potential is the main limitation in the Lakoa soil. The moderate permeability in both soils is an additional limitation. Construction activities are hindered on the Rockoa soil because of numerous large rocks. Backfilling with sandy material, installing foundation drains, and diverting runoff away from the dwellings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Enlarging

the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste.

These soils are severely limited as sites for hard-surfaced roads and streets. The numerous rock fragments in the Rockoa soil hinder construction activities. Low strength is the main limitation in the Lakoa soil. Providing coarse grained subgrade or base material in areas of the Lakoa soil helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity during wet periods.

The land capability classification of the Rockoa soil is VIIe-1, and the grazable woodland group is Cool Slopes. The land capability classification of the Lakoa soil is VIe-13, and the grazable woodland group is Silty Foot Slopes.

RrE—Rockoa-Lakoa-Rock outcrop complex, 10 to 40 percent slopes. This map unit consists of deep, well drained, strongly sloping to steep Rockoa and Lakoa soils intermingled with areas of Rock outcrop. It is on mountains on the Dakota Hogback. The Rockoa and Lakoa soils formed in material weathered from interbedded sandstone and shale. They are on side slopes. The areas of Rock outcrop are less than 3 acres in size. They are generally on the upper side slopes and on ridges. Elevation ranges from 3,500 to 6,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 1,400 acres in size. They are 35 to 45 percent Rockoa soil, 25 to 35 percent Lakoa soil, and 10 to 20 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Rockoa soil. The surface soil is dark grayish brown and light brownish gray cobbly fine sandy loam about 6 inches thick. The next 3 inches is light brown very cobbly clay loam and light brownish gray cobbly fine sandy loam. The subsoil is light brown, pink, and pinkish gray, friable and firm very cobbly clay loam about 17 inches thick. The underlying material to a depth of about 60 inches is pinkish white extremely cobbly fine sandy loam. In some areas the depth to bedrock is 30 to 60 inches. In other areas the subsoil has more sand and less clay.

Typically, about 1 inch of forest litter is on the surface of the Lakoa soil. The surface layer is gray very fine sandy loam about 5 inches thick. The next 6 inches is yellowish brown clay loam and pale brown sandy loam. The subsoil is yellowish brown, light yellowish brown, and pale brown, firm and friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is very pale brown, calcareous gravelly clay loam. In some areas the subsoil is redder. In other areas it has more silt and less sand.

The Rock outcrop generally is light gray, very pale brown, or reddish yellow, hard sandstone. In some areas, however, it is gray or red shale. It occurs as low-relief slabs that are parallel to the surface.

Included in this unit in mapping are small areas of Butche and Vanocker soils. These soils make up less than 15 percent of any one mapped area. Butche soils have bedrock at a depth of 10 to 20 inches. They are adjacent to the areas of Rock outcrop. Vanocker soils have a surface layer and subsoil that are thinner than those of the Rockoa and Lakoa soils. They are in landscape positions similar to those of the Rockoa soil.

The available water capacity is moderate in the Rockoa soil and high in the Lakoa soil. Permeability is moderate in both soils. The shrink-swell potential is low in the Rockoa soil and moderate in the Lakoa soil. Runoff is medium on both soils.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 55 on the Rockoa soil and 65 on the Lakoa soil. The Lakoa soil supports some bur oak, quaking aspen, eastern hophornbeam, and paper birch. The bur oak and eastern hophornbeam are at the lower elevations along the eastern side of the survey area. The understory is dominantly little bluestem, brome, sedges, oatgrass, snowberry, rose, Saskatoon serviceberry, and russet buffaloberry.

Some areas below the Rock outcrop have large boulders on the surface. These boulders interfere with felling and the use of skidding equipment and other equipment. Water erosion can be controlled by reseeding disturbed areas and by installing water bars and culverts. Mass soil movement may occur if the steep slopes are disturbed.

This map unit is well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species.

The Rockoa and Lakoa soils are severely limited as sites for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The numerous large rocks on the Rockoa soil, low strength in the Lakoa soil, and the slope of both soils are the main limitations. Better suited sites generally are available. Building unsurfaced roads on the contour and in the less sloping areas helps to overcome the slope and control water

erosion. Applying gravel to these roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Rockoa soil is VIIe-1, and the grazable woodland group is Cool Slopes. The land capability classification of the Lakoa soil is VIe-13, and the grazable woodland group is Silty Foot Slopes. The land capability classification of the Rock outcrop is VIIIs-1; no grazable woodland group is assigned.

RsF—Rockoa-Rock outcrop complex, 25 to 60 percent slopes. This map unit consists of a deep, well drained, steep and very steep Rockoa soil intermingled with areas of Rock outcrop. It is on mountains on the Dakota Hogback. The Rockoa soil formed in material weathered from interbedded sandstone and shale. It is on side slopes. The areas of Rock outcrop generally are less than 3 acres in size. They are on ridges and the upper side slopes. Elevation ranges from 3,200 to 5,500 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 1,000 acres in size. They are 50 to 60 percent Rockoa soil and 20 to 30 percent Rock outcrop. The Rockoa soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Rockoa soil. The surface soil is dark grayish brown and light brownish gray cobbly fine sandy loam about 6 inches thick. The next 3 inches is light brown very cobbly clay loam and light brownish gray cobbly fine sandy loam. The subsoil is light brown, pink, and pinkish gray, firm and friable very cobbly clay loam about 17 inches thick. The underlying material to a depth of 60 inches is pinkish white extremely cobbly fine sandy loam. In some areas the depth to bedrock is 30 to 60 inches.

The Rock outcrop generally is light gray, very pale brown, or reddish yellow, hard sandstone. In some areas, however, it is gray, red, and purple shale. It generally occurs as ledges or dikes along ridges. In some areas weathering has caused rock slides below the Rock outcrop.

Included in this unit in mapping are small areas of Butche, Canyon, and Lakoa soils. These soils make up less than 20 percent of any one mapped area. Butche and Canyon soils have bedrock at a depth of 10 to 20 inches. They are in landscape positions similar to those of the Rockoa soil. Lakoa soils have fewer rock fragments than the Rockoa soil. They are in swales.

The available water capacity is moderate in the Rockoa soil. Permeability also is moderate. Runoff is medium.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 55 on the Rockoa soil. The understory is dominantly little bluestem, sedges, brome, snowberry, Saskatoon serviceberry, and russet buffaloberry.

The Rock outcrop, boulders, and steep to very steep slopes restrict use of wheeled and tracked logging equipment. When timber is harvested, a cable logging system helps to overcome the slope and to control water erosion. Road construction in steep and very steep areas requires cutting and filling on long slopes. The cutting and filling increase the erosion hazard. Erosion can be controlled by reseeding disturbed areas and by installing water bars and culverts. Mass soil movement may occur if the surface is disturbed.

This map unit is suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. Water erosion is a hazard along some cattle trails. The very steep slopes may restrict livestock grazing. The number of sites suitable for watering facilities is limited.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. It is poorly suited to unsurfaced roads. The steep and very steep slopes, the Rock outcrop, and large stones are the main limitations. Better suited sites generally are available. Building unsurfaced roads on the contour and in the less sloping areas helps overcome the slope.

The land capability classification of the Rockoa soil is VIIe-1, and the grazable woodland group is Cool Slopes. The land capability classification of the Rock outcrop is VIIIs-1; no grazable woodland group is assigned.

RtD—Rockoa-Satanta complex, 6 to 30 percent slopes. These deep, well drained, moderately sloping to steep soils are on mountain side slopes and broad upland divides on the Dakota Hogback. The Rockoa soil formed in loamy material weathered from interbedded sandstone and shale. It is on steep, forested side slopes. The Satanta soil formed in alluvium. It is in meadows on foot slopes. Scattered cobbles and stones are on the surface. Elevation ranges from 3,200 to 4,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are

10 to 500 acres in size. They are 45 to 55 percent Rockoa soil and 30 to 40 percent Satanta soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Rockoa soil. The surface soil is dark grayish brown and light brownish gray cobbly fine sandy loam about 6 inches thick. The next 3 inches is light brown very cobbly clay loam and light brownish gray cobbly fine sandy loam. The subsoil is light brown, pink, and pinkish gray, firm and friable very cobbly clay loam about 17 inches thick. The underlying material to a depth of 60 inches is pinkish white extremely cobbly fine sandy loam. In some areas the depth to bedrock is 30 to 60 inches.

Typically, the surface layer of the Satanta soil is dark grayish brown fine sandy loam about 4 inches thick. The subsoil is about 18 inches thick. It is dark brown and brown, firm sandy clay loam in the upper part and pale brown, friable, calcareous fine sandy loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, calcareous fine sandy loam. In some areas the subsoil has more sand and less silt.

Included with these soils in mapping are small areas of Butche, Canyon, and Lakoa soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. Butche and Canyon soils are shallow over bedrock. They are on ridges. Lakoa soils have fewer coarse fragments than the Rockoa soil. They are in wooded swales. The areas of Rock outcrop are on low ridges and high parts of the landscape.

The available water capacity is moderate in the Rockoa soil and high in the Satanta soil. Permeability is moderate in both soils. The shrink-swell potential is low in the Rockoa soil. It is moderate in the subsoil of the Satanta soil and low in the underlying material. Runoff is medium.

Most of the acreage of the Rockoa soil is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 55 on the Rockoa soil. Some bur oak grows on the edges of the forested areas. The understory is dominantly little bluestem, brome, sedges, russet buffaloberry, Saskatoon serviceberry, and snowberry.

In some areas below the Rock outcrop, large boulders on the surface restrict the use of logging equipment. Constructing unsurfaced roads on the contour helps to overcome the slope. Erosion can be controlled by reseeding disturbed areas and by installing water bars and culverts. Mass soil movement may occur in steep areas if the surface is disturbed.

Most of the acreage of the Satanta soil supports native grass and is used for grazing. This map unit is well suited to the production of forage for livestock and big game animals. No major hazards or limitations affect the use of these soils for grazing. Proper stocking rates and a uniform distribution of grazing help to maintain maximum productivity of the desirable forage species. Because of the slope, watering facilities should be located on the less sloping parts of the landscape.

These soils generally are unsuited to cultivated crops and to tame pasture and hay because of the slope, the cobbles in the Rockoa soil, and the isolated, inaccessible areas of the Satanta soil.

The Rockoa soil generally is unsuited to mechanically planted windbreaks because it has numerous rock fragments throughout. The Satanta soil is suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well on this soil, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

The Satanta soil has slight limitations if used as a site for dwellings or septic tank absorption fields. The Rockoa soil, however, is severely limited, mainly because of the numerous large stones and the slope. Construction activities are hindered by the numerous large rocks. Designing dwellings so that they conform to the natural slope of the land helps to overcome the slope. Land shaping is needed in some areas. Land shaping and installing the distribution lines across the slope in areas of the Satanta soil help to ensure that septic tank absorption fields function properly.

The Rockoa soil has severe limitations and the Satanta soil moderate limitations if used as a site for hard-surfaced roads and streets. The roads and streets should be built on the Satanta soil because of the large stones, steep slope, and hazard of mass soil movement in areas of the Rockoa soil. Frost action is a hazard on the Satanta soil. Constructing the roads on raised, well compacted material and providing adequate roadside ditches and culverts help to prevent the damage caused by frost action. Applying gravel to unsurfaced roads improves the traffic-supporting capacity during wet periods.

The land capability classification of the Rockoa soil is VIIe-1, and the grazable woodland group is Cool Slopes. The land capability classification of the Satanta soil is IVe-1, the grazable woodland group is Silty, and the windbreak suitability group is 3.

SeB—Satanta loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces and alluvial fans. It formed in loamy alluvium. Elevation

ranges from 3,200 to 4,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches. Areas are irregular in shape and are 5 to 100 acres in size.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The next layer also is dark grayish brown loam. It is about 3 inches thick. The subsoil is about 25 inches thick. It is yellowish brown, firm clay loam in the upper part and pale brown, calcareous, friable loam in the lower part. The underlying material to a depth of about 60 inches is pale brown, calcareous loam. In some areas the subsoil has less sand and more silt. In other areas it is redder.

Included with this soil in mapping are small areas of Butche, Canyon, and Rockoa soils. These soils make up less than 10 percent of any one mapped area. The shallow Butche and Canyon soils are on ridges and slope breaks. The deep Rockoa soils have rock fragments throughout. They are in forested areas.

Fertility is medium and the content of organic matter moderate in the Satanta soil. The available water capacity is high. Permeability is moderate. The shrink-swell potential is moderate in the subsoil and low in the underlying material. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to cultivated crops and to tame pasture and hay. Green needlegrass, intermediate wheatgrass, and smooth brome are examples of suitable pasture plants. Small grain and alfalfa are the main crops. Conserving moisture and controlling erosion are management concerns in cultivated areas. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control water erosion and conserve moisture. Contour farming, grassed waterways, and terraces help to control water erosion.

This soil is only slightly limited as a site for dwellings and septic tank absorption fields. Septic tank absorption fields function well. The soil is moderately limited as a site for hard-surfaced roads and streets. Frost action is a hazard. Constructing roads on well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by frost action. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

The land capability classification is IIIe-1, and the range site is Silty. The windbreak suitability group is 3.

SfB—Satanta-Arvada complex, 2 to 6 percent slopes. These deep, well drained, gently sloping soils are on upland terraces. They formed in loamy alluvium. The Satanta soil is on micro-highs. The Arvada soil is in micro-lows. Elevation ranges from 3,500 to 4,500 feet above sea level. Annual precipitation ranges from 14 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 200 acres in size. They are 55 to 65 percent Satanta soil and 25 to 35 percent Arvada soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Satanta soil is dark grayish brown loam about 6 inches thick. The next layer also is dark grayish brown loam. It is about 3 inches thick. The subsoil is about 25 inches thick. It is yellowish brown, firm clay loam in the upper part and pale brown, calcareous, friable loam in the lower part. The underlying material to a depth of about 60 inches is pale brown, calcareous loam. In some areas the subsoil and underlying material have more clay. In other areas they are redder.

Typically, the surface layer of the Arvada soil is light gray fine sandy loam about 3 inches thick. The subsoil is brown and pale brown, very firm and firm clay about 17 inches thick. In the lower part it is calcareous and has accumulations of salts. The underlying material to a depth of about 60 inches is light brownish gray, calcareous clay. In some areas the depth to a seasonal high water table is 1 to 3 feet.

Included with these soils in mapping are small areas of Hilger and Nihill soils. These included soils make up less than 10 percent of any one mapped area. The cobbly Hilger soils are on high parts of the landscape. The gravelly Nihill soils are in landscape positions similar to those of the Satanta soil.

Fertility is medium in the Satanta soil and low in the Arvada soil. The content of organic matter is moderate in the Satanta soil and low in the Arvada soil. The available water capacity is high in the Satanta soil and low in the Arvada soil. Permeability is moderate in the Satanta soil and very slow in the Arvada soil. The shrink-swell potential is moderate in the subsoil of the Satanta soil and low in the underlying material. It is high in the Arvada soil. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a management concern on the Arvada soil. Restricted grazing during wet periods helps to prevent compaction and the deterioration of tilth.

This unit is poorly suited to cultivated crops and tame pasture and hay because of poor tilth, excess salts, an

unfavorable root zone, and the very slow permeability in the Arvada soil. Alfalfa, intermediate wheatgrass, and pubescent wheatgrass are examples of suitable pasture plants on the Satanta soil. Small grain and alfalfa are the main crops. No crops or pasture plants grow well on the Arvada soil.

Conserving moisture, controlling erosion, and maintaining tilth are the main management concerns in cultivated areas. Leaving crop residue on the surface and minimizing tillage help to control erosion and conserve moisture. Regular additions of manure and incorporation of grasses and legumes into the cropping system help to maintain tilth and control erosion.

The Satanta soil has slight limitations and the Arvada soil severe limitations if used as a site for dwellings and septic tank absorption fields. The high shrink-swell potential and very slow permeability in the Arvada soil are the main limitations. Backfilling with sandy material, installing foundation drains, and diverting runoff away from the dwellings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Enlarging the absorption area in the septic tank absorption fields helps overcome the slow absorption of liquid waste in the Arvada soil.

The Satanta soil has moderate limitations and the Arvada soil severe limitations if used as a site for hard-surfaced roads and streets. Low strength and the shrink-swell potential of the Arvada soil are the main limitations. Frost action is a hazard on the Satanta soil. Constructing roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by shrinking and swelling and by frost action. Providing coarse grained subgrade or base material helps to overcome low strength in the Arvada soil. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Satanta soil is IIIe-1, the range site is Silty, and the windbreak suitability group is 3. The land capability classification of the Arvada soil is VIs-3, the range site is Thin Claypan, and the windbreak suitability group is 10.

ShD—Satanta-Canyon loams, 6 to 15 percent slopes. These well drained, moderately sloping and strongly sloping soils are on alluvial fans and side slopes on the Dakota Hogback. They formed in loamy material weathered from interbedded sandstone and limestone. The deep Satanta soil is on the lower side slopes and on foot slopes. The shallow Canyon soil is on ridges and the upper side slopes. In some areas scattered cobbles and stones are on the surface. Elevation ranges from 3,200 to 4,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 5 to 200 acres in size. They are 55 to 65 percent Satanta soil and 20 to 30 percent Canyon soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Satanta soil is dark grayish brown loam about 6 inches thick. The next layer also is dark grayish brown loam. It is about 3 inches thick. The subsoil is about 25 inches thick. It is yellowish brown, firm clay loam in the upper part and pale brown, calcareous, friable loam in the lower part. The underlying material to a depth of about 60 inches is pale brown, calcareous loam. In some areas the subsoil and underlying material have more clay. In other areas they have less sand and more silt.

Typically, the surface layer of the Canyon soil is brown, calcareous loam about 4 inches thick. Below this is a transitional layer of very pale brown, friable, calcareous gravelly loam about 6 inches thick. The underlying material is very pale brown, calcareous gravelly loam about 8 inches thick. Light gray, calcareous, interbedded weakly cemented fine grained sandstone and fractured limestone are at a depth of about 18 inches. In some areas the soil is not calcareous. In other areas hard sandstone is at a depth of 7 to 20 inches.

Included with these soils in mapping are small areas of Rockoa and Zigweid soils. These included soils make up less than 15 percent of any one mapped area. Rockoa soils have coarse fragments throughout. They are on forested side slopes. The deep Zigweid soils are calcareous at or near the surface. They are in landscape positions similar to those of the Satanta soil.

Fertility is medium in the Satanta soil and low in the Canyon soil. The content of organic matter is moderate in the Satanta soil and low in the Canyon soil. The available water capacity is high in the Satanta soil and very low in the Canyon soil. Permeability is moderate in both soils. The shrink-swell potential is moderate in the subsoil of the Satanta soil and low in the underlying material. It is low in the Canyon soil. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Proper stocking rates and rotation grazing help to control erosion and maintain maximum productivity. Reestablishing vegetation is difficult in denuded areas.

The Satanta soil is poorly suited and the Canyon soil

unsuited to cultivated crops and to tame pasture and hay. Alfalfa, green needlegrass, and pubescent wheatgrass are examples of suitable pasture plants in areas of the Satanta soil. Alfalfa and oats are the main crops. Measures that control water erosion and conserve moisture, such as leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system, are needed in cultivated areas of the Satanta soil.

The Satanta soil is suited to windbreaks and environmental plantings, but the Canyon soil generally is unsuited. All climatically suited trees and shrubs grow well on the Satanta soil. No trees or shrubs grow well on the Canyon soil. Planting on the contour helps to control erosion.

The Satanta soil has slight limitations and the Canyon soil moderate limitations if used as a site for dwellings. The slope is a limitation in areas of the Canyon soil. Designing dwellings so that they conform to the natural slope of the land helps to overcome the slope. Land shaping is needed in some areas.

The Satanta soil has slight limitations and the Canyon soil severe limitations if used as a site for septic tank absorption fields. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water in the Canyon soil.

These soils are moderately limited as sites for hard-surfaced roads and streets. The slope is the main limitation. Frost action is a hazard on the Satanta soil. Constructing roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by frost action. Building roads and streets on the contour helps to overcome the slope. Reseeding disturbed areas helps to control erosion. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Satanta soil is IVe-1, the range site is Silty, and the windbreak suitability group is 3. The land capability classification of the Canyon soil is VIe-11, the range site is Shallow, and the windbreak suitability group is 10.

SpE—Sawdust-Hopdraw-Paunsaugunt complex, 10 to 40 percent slopes. These well drained and excessively drained, strongly sloping to steep soils are on mountains in the southern part of the Limestone Plateau. They formed in material weathered from limestone and sandstone. The deep Sawdust and Hopdraw soils are on side slopes and foot slopes. The shallow Paunsaugunt soil is on ridges. Elevation ranges from 3,500 to 6,200 feet above sea level. Annual precipitation ranges from 16 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to 3,000 acres in size. They are 35 to 45 percent Sawdust soil, 25 to 35 percent Hopdraw soil, and 15 to 25 percent Paunsaugunt soil. The three soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Sawdust soil is dark grayish brown, calcareous channery loam about 4 inches thick. The next layer is pale brown, friable, calcareous very channery loam about 4 inches thick. The upper part of the underlying material is light yellowish brown, calcareous very channery loam. The next part is very pale brown, calcareous extremely channery loam. The lower part to a depth of about 60 inches is yellow, calcareous extremely channery sandy loam. In some areas the depth to bedrock is 20 to 40 inches.

Typically, the surface layer of the Hopdraw soil is grayish brown, calcareous cobbly loamy fine sand about 3 inches thick. The underlying material is pale brown, light gray, and very pale brown, loose, calcareous very gravelly loamy fine sand. Pink, calcareous, hard sandstone is at a depth of about 44 inches. In some areas the soil is noncalcareous. In other areas it has fewer pebbles or cobbles.

Typically, the surface layer of the Paunsaugunt soil is dark brown, calcareous gravelly loam about 2 inches thick. The subsurface layer is brown, calcareous gravelly loam about 4 inches thick. The underlying material is brown, calcareous very gravelly loam. Light brown limestone bedrock is at a depth of about 11 inches. In some areas the depth to bedrock is 20 to 40 inches or is less than 10 inches.

Included with these soils in mapping are small areas of Citadel and Vanocker soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. The deep Citadel and Vanocker soils have less sand and more clay than the Hopdraw and Sawdust soils. Citadel soils are in coves and along drainageways. Vanocker soils are in landscape positions similar to those of the Hopdraw soil. The areas of Rock outcrop are on high parts of the landscape.

The available water capacity is moderate in the Sawdust soil and very low in the Hopdraw and Paunsaugunt soils. Permeability is moderate in the Sawdust and Paunsaugunt soils and rapid in the Hopdraw soil. Runoff is medium on all three soils.

Most of the acreage is used for timber. The canopy generally is sparse. The overstory is dominantly ponderosa pine. The soils support some Rocky

Mountain juniper. The sandy Hopdraw soil and the shallow Paunsaugunt soil have a limited potential for timber production. The site index for ponderosa pine is about 50 on the Sawdust soil, 35 on the Hopdraw soil, and 45 on the Paunsaugunt soil. The understory is dominantly little bluestem, sideoats grama, sedges, oatgrass, mountainmahogany, skunkbush sumac, common juniper, and yucca.

The slope, the erosion hazard, and windthrow hazard are the main concerns in managing timbered areas. Building unsurfaced roads on the contour helps to overcome the slope. Erosion can be controlled by reseeding disturbed areas and by installing water bars and culverts. The windthrow hazard is severe on the Paunsaugunt soil. It can be reduced by thinning and harvest methods that do not isolate the remaining trees or leave them widely spaced.

These soils are suited to the production of forage for livestock and big game animals. They are well suited to grazing by big game animals. The browse species include mountainmahogany and skunkbush sumac. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. The number of sites suitable for watering facilities is limited.

These soils have severe limitations if used as sites for dwellings and hard-surfaced roads and streets. Large rock fragments in the Sawdust and Hopdraw soils, bedrock at a depth of 10 to 20 inches in the Paunsaugunt soil, and the steep slopes are the main limitations. Better suited sites generally are available. Unsurfaced roads in areas of the Paunsaugunt soil may require additions of borrow material. Applying gravel to these roads improves the traffic-supporting capacity during wet periods.

These soils are severely limited as sites for septic tank absorption fields. The slope, large stones in the Sawdust and Hopdraw soils, a poor filtering capacity in the Hopdraw soil, and a thin layer of suitable material and seepage in the Paunsaugunt soil are the main limitations. Better suited sites generally are available.

The land capability classification of the Sawdust and Hopdraw soils is VIIe-9, and the grazable woodland group is Warm Slopes. The land capability classification of the Paunsaugunt soil is VIIs-1, and the grazable woodland group is Shallow Ridge.

SrE—Sawdust-Vanocker-Paunsaugunt complex, 10 to 40 percent slopes. These well drained, strongly sloping to steep soils are on mountains at the lower elevations on the Limestone Plateau. These soils formed in material weathered from limestone and calcareous sandstone. The deep Sawdust soil is generally on side slopes that have a south aspect. The deep Vanocker soil is generally on side slopes that have a north aspect. The shallow Paunsaugunt soil is on the upper side slopes and on ridges. Elevation ranges from 3,400 to 6,200 feet above sea level. Annual precipitation ranges from 16 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to several thousand acres in size. They are 35 to 45 percent Sawdust soil, 25 to 35 percent Vanocker soil, and 10 to 20 percent Paunsaugunt soil. The three soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Sawdust soil is dark grayish brown, calcareous channery loam about 4 inches thick. The next layer is pale brown, friable, calcareous very channery loam about 4 inches thick. The upper part of the underlying material is light yellowish brown, calcareous very channery loam. The next part is very pale brown, calcareous extremely channery loam. The lower part to a depth of about 60 inches is yellow, calcareous extremely channery sandy loam. In some areas the soil has more sand and less clay. In other areas the depth to bedrock is 20 to 40 inches.

Typically, about 1 inch of forest litter is on the surface of the Vanocker soil. The surface layer is brown channery loam about 2 inches thick. The subsoil is brown and pale brown, firm and friable very channery clay loam about 11 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is very pale brown, calcareous very channery loam. In some areas the depth to bedrock is 20 to 40 inches.

Typically, the surface layer of the Paunsaugunt soil is dark brown, calcareous gravelly loam about 2 inches thick. The subsurface layer is brown, calcareous gravelly loam about 4 inches thick. The underlying material is brown, calcareous very gravelly loam. Light brown limestone bedrock is at a depth of about 11 inches. In some areas the depth to bedrock is 20 to 40 inches or is less than 10 inches.

Included with these soils in mapping are small areas of Citadel, Gurney, and Lakoa soils and areas of Rock outcrop. Inclusions make up less than 20 percent of any one mapped area. The deep Citadel soils have more clay and fewer rock fragments in the subsoil than the Sawdust and Vanocker soils. They are on low parts of the landscape. Gurney soils have fewer rock fragments than the Sawdust, Vanocker, and Paunsaugunt soils. They are in meadows. The deep Lakoa soils have fewer rock fragments in the subsoil than the Sawdust,

Vanocker, and Paunsaugunt soils. They are on low parts of the landscape. The areas of Rock outcrop occur as bare slabs of rock that are parallel to the slopes or as thin ledges at the crest of the slopes.

The available water capacity is moderate in the Sawdust and Vanocker soils and very low in the Paunsaugunt soil. Permeability is moderate in all three soils. The shrink-swell potential is moderate in the Vanocker soil and low in the Sawdust and Paunsaugunt soils. Runoff is medium on all three soils.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. On south aspects the Sawdust soil supports open stands of timber. On north aspects the Vanocker soil supports fairly dense stands. The site index for ponderosa pine is about 50 on the Sawdust soil, 62 on the Vanocker soil, and 45 on the Paunsaugunt soil. The understory is dominantly little bluestem, sideoats grama, sedges, brome, common juniper, snowberry, and Saskatoon serviceberry.

The slope, the hazard of erosion, and the windthrow hazard are the main concerns in managing timbered areas. Building unsurfaced roads on the contour helps to overcome the slope. Erosion can be controlled by reseeding disturbed areas and by installing water bars and culverts. The windthrow hazard is severe on the Paunsaugunt soil. It can be reduced by thinning and harvesting methods that do not isolate the remaining trees or leave them widely spaced.

This unit is suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. The number of sites for suitable watering facilities is limited.

These soils are severely limited as sites for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The slope, large rock fragments in the Sawdust soil, and a thin layer of suitable material and seepage in the Paunsaugunt soil are the main limitations. Better suited sites generally are available. Unsurfaced roads in areas of the Paunsaugunt soil may require additions of borrow material. Applying gravel to these roads improves the traffic-supporting capacity during wet periods.

The land capability classification of the Sawdust and Vanocker soils is VIIe-9. The grazable woodland group is Warm Slopes for the Sawdust soil and Cool Slopes for the Vanocker soil. The land capability classification of the Paunsaugunt soil is VIIs-1, and the grazable woodland group is Shallow Ridge.

SwE—Shirttail channery loam, 10 to 40 percent slopes. This deep, well drained, strongly sloping to steep soil is on mountains in the Central Crystalline Area. It formed in residuum of metamorphic and igneous rock. Elevation ranges from 4,500 to 5,500 feet above sea level. Annual precipitation ranges from 16 to 18 inches. Areas are irregular in shape and are 10 to 1,000 acres in size.

Typically, the surface layer is dark grayish brown channery loam about 6 inches thick. The subsoil is strong brown and yellowish brown, firm and friable very channery clay loam about 12 inches thick. The underlying material is about 26 inches thick. It is yellowish brown. It is very channery loam in the upper part and very channery loamy fine sand in the lower part. Consolidated metamorphic rock is at a depth of about 44 inches. In some areas the lower part of the subsoil is calcareous. In other areas the depth to bedrock is 20 to 40 inches.

Included with this soil in mapping are small areas of Buska, Heely, and Mocmont soils and areas of Rock outcrop. Also included are small areas where stones cover as much as 25 percent of the surface. Inclusions make up less than 20 percent of any one mapped area. They are in landscape positions similar to those of the Shirttail soil. Buska and Mocmont soils formed under forest vegetation. Their surface layer is thinner than that of the Shirttail soil. Also, Buska soils contain more mica. Heely soils have less clay in the subsoil than the Shirttail soil and have bedrock at a depth of 20 to 40 inches. The areas of Rock outcrop are on the mid and high parts of the landscape. They generally are granitic or metamorphic bedrock.

Fertility is medium and the content of organic matter moderate in the Shirttail soil. The available water capacity is low. Permeability is moderate. Runoff is medium or rapid.

Most of the acreage supports native grasses and is used for grazing. This soil generally supports a thin stand of ponderosa pine. Water erosion is a hazard unless an adequate plant cover is maintained. Proper stocking rates and rotation grazing help to control water erosion and maintain maximum productivity. Reestablishing vegetation is difficult in denuded areas.

This soil generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. Scattered stones on the surface and the slope are the main limitations.

This soil is severely limited as a site for dwellings and hard-surfaced roads and streets. Large stones hinder site development. The sides of shallow excavations can cave in unless they are shored. Designing dwellings, roads, and streets so that they conform to the natural slope of the land minimizes the

amount of land shaping needed to overcome the slope. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

This soil is severely limited as a site for septic tank absorption fields. Installation of the absorption fields is hindered by numerous large stones. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly.

The land capability classification is VIIe-9, and the range site is Savannah. The windbreak suitability group is 10.

SxaE—Spearfish-Nevee silt loams, 9 to 30 percent slopes. These strongly sloping to steep soils are on uplands in the Red Valley. They formed in material weathered from reddish siltstone, sandstone, and silty shale. The shallow, excessively drained Spearfish soil is on side slopes. The deep, well drained Nevee soil is on foot slopes. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 5 to 250 acres in size. They are 40 to 50 percent Spearfish soil and 35 to 45 percent Nevee soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Spearfish soil is reddish brown, calcareous silt loam about 8 inches thick. The underlying material is yellowish red, calcareous silt loam. Reddish yellow, calcareous, silty shale is at a depth of about 12 inches. In some areas the depth to bedrock is 20 to 40 inches.

Typically, the surface layer of the Nevee soil is red, calcareous silt loam about 8 inches thick. The underlying material to a depth of about 60 inches is firm, calcareous, reddish yellow silt loam and light red loam. In some areas channers are in the surface soil.

Included with these soils in mapping are small areas of Gypnevee, Rekop, and Tilford soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. Gypnevee and Rekop soils have more gypsum than the Spearfish and Nevee soils. Gypnevee soils are in landscape positions similar to those of the Nevee soil. Rekop soils are in landscape positions similar to those of the Spearfish soil. The deep Tilford soils have a dark surface layer and have more clay than the Nevee soil. They are on low parts of the landscape. The Rock outcrop is reddish siltstone, sandstone, or silty shale. It generally is on high parts of the landscape.

Fertility and the content of organic matter are low in the Spearfish and Nevee soils. The available water capacity is very low in the Spearfish soil and high in the Nevee soil. Permeability is moderate in both soils. The Spearfish soil has a shallow rooting depth. Runoff is rapid on the Spearfish soil and medium on the Nevee soil.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Proper stocking rates and rotation grazing help to control water erosion and maintain maximum productivity. Reestablishing vegetation is difficult in denuded areas.

This map unit generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. The shallowness to bedrock in the Spearfish soil, low fertility in both soils, and the steep slopes are the main limitations.

This map unit has severe limitations if used as a site for dwellings or hard-surfaced roads and streets. The slope is the main limitation. Designing dwellings and roads and streets so that they conform to the natural slope of the land minimizes the amount of land shaping needed to overcome the slope. Applying gravel to unsurfaced roads improves the traffic-supporting capacity during wet periods. Unsurfaced roads in areas of the Spearfish soil may require additions of borrow material.

These soils are severely limited as sites for septic tank absorption fields. A thin layer of suitable material and seepage in the Spearfish soil and the slope are the main limitations. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water in the Spearfish soil.

The land capability classification of the Spearfish soil is VIe-11, and the range site is Shallow. The land capability classification of the Nevee soil is VIe-3, and the range site is Thin Upland. The windbreak suitability group is 10 for both soils.

SxbF—Spearfish-Rock outcrop complex, 25 to 60 percent slopes. This map unit consists of a shallow, excessively drained, steep and very steep Spearfish soil intermingled with areas of Rock outcrop. It is on uplands in the Red Valley. The Spearfish soil is on side slopes. It formed in material weathered from reddish siltstone and silty shale. The areas of Rock outcrop are generally less than 3 acres in size. They are on ridges and escarpments. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 300 acres in size. They are 45 to 55 percent Spearfish soil and 35 to 45 percent Rock outcrop. The Spearfish soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Spearfish soil is reddish brown, calcareous silt loam about 8 inches thick. The underlying material is yellowish red, calcareous silt loam. Reddish yellow, calcareous, silty shale is at a depth of about 12 inches. In some areas the depth to bedrock is 20 to 40 inches.

The Rock outcrop consists of barren areas of reddish siltstone or silty shale.

Included in this unit in mapping are small areas of Gypnevee and Rekop soils. Also included are small areas that have rounded cobbles and stones on the surface. Included soils make up less than 15 percent of any one mapped area. Gypnevee soils have more than 40 percent, by weight, carbonates plus gypsum. They are on low parts of the landscape. Rekop soils are underlain by gypsum bedrock. They are in landscape positions similar to those of the Spearfish soil.

Fertility and the content of organic matter are low in the Spearfish soil. The rooting depth is shallow. The available water capacity is very low. Permeability is moderate. Runoff is rapid.

Most of the acreage supports native grasses and is used for grazing by big game animals. Some areas support a few scattered ponderosa pine trees. Livestock grazing is restricted because of the slope. Controlling erosion and maintaining a good plant cover are the main management concerns. Reestablishing vegetation in denuded areas is difficult.

This unit generally is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. Limitations include the shallowness to bedrock, the steep and very steep slopes, and the Rock outcrop.

This unit has severe limitations if used as a site for dwellings, septic tank absorption fields, or hard-surfaced roads and streets. The shallowness to bedrock in the Spearfish soil, the Rock outcrop, and the steep and very steep slopes are the main limitations. Better suited sites generally are available. Applying gravel to unsurfaced roads improves the traffic-supporting capacity during wet periods. Unsurfaced roads in areas of the Spearfish soil may require additions of borrow material.

The land capability classification of the Spearfish soil is VIIe-4, the range site is Shallow, and the windbreak suitability group is 10. The land capability classification of the Rock outcrop is VIIIs-1; no range site or windbreak suitability group is assigned.

SyaC—Stovho silt loam, 2 to 15 percent slopes. This deep, well drained, gently sloping to strongly sloping soil is on mountains at the higher elevations on the Limestone Plateau. The soil formed in material weathered from limestone and calcareous sandstone. Elevation ranges from 6,200 to 7,200 feet above sea level. Annual precipitation ranges from 20 to 24 inches. Areas generally are long and narrow and are 10 to 200 acres in size.

Typically, about 1 inch of forest litter is on the surface of the Stovho soil. The surface layer is dark gray silt loam about 2 inches thick. The subsurface layer is light gray silt loam about 4 inches thick. The next 2 inches is pale brown silty clay loam and light gray silt loam. The subsoil is about 22 inches thick. It is yellowish brown, firm silty clay in the upper part and light yellowish brown, firm, calcareous silty clay loam in the lower part. The underlying material to a depth of about 60 inches is yellow, calcareous channery silty clay loam. In some areas the subsoil has less clay. In other areas it is redder.

Included with this soil in mapping are small areas of Heath, Redbird, and Trebor soils and areas of Rock outcrop. Inclusions make up less than 20 percent of any one mapped area. Heath and Redbird soils are in meadows. Their surface layer is thicker and darker than that of the Stovho soil. Trebor soils have bedrock at a depth of 20 to 40 inches. Trebor soils and the Rock outcrop are on high parts of the landscape.

The available water capacity is high in the Stovho soil. Permeability is slow. The shrink-swell potential is high in the subsoil and moderate in the underlying material. Runoff is medium.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 76. Some quaking aspen, paper birch, and Black Hills spruce grow on this soil. The understory is dominantly sedges, bearded wheatgrass, oatgrass, brome, juniper, snowberry, Oregongrape, and bearberry. When the soil is wet, logging activities, such as skidding, hauling, and construction, can cause surface compaction and the formation of ruts. These activities should be performed when the soil is dry or frozen.

This soil is well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. Generally,

there are many sites that are suitable for watering facilities.

This soil is moderately limited as a site for dwellings. The slope and the shrink-swell potential are the main limitations. Designing dwellings so that they conform to the natural slope of the land minimizes the amount of land shaping needed to overcome the slope. Backfilling with sandy material, installing foundation drains, and diverting runoff away from the dwellings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

This soil is severely limited as a site for septic tank absorption fields and hard-surfaced roads and streets. The slow permeability and low strength are the main limitations. Enlarging the absorption area in septic tank absorption fields helps to overcome the slow absorption of liquid waste. Providing coarse grained subgrade or base material for hard-surfaced roads and streets helps to prevent the damage caused by low strength.

The land capability classification is VIe-13, and the grazable woodland group is High Woodland.

SybC—Stovho-Lail-Trebor complex, 2 to 12 percent slopes. These well drained, gently sloping to strongly sloping soils are on broad ridgetops and mountain side slopes at the higher elevations on the Limestone Plateau. They formed in material weathered from limestone and calcareous sandstone. The deep Stovho and Lail soils are on side slopes and foot slopes. The moderately deep Trebor soil is on ridges. Elevation ranges from 6,200 to 7,200 feet above sea level. Annual precipitation ranges from 20 to 24 inches.

Areas of this map unit are irregular in shape and are 10 acres to several thousand acres in size. They are 35 to 45 percent Stovho soil, 25 to 35 percent Lail soil, and 15 to 25 percent Trebor soil. The three soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Stovho soil. The surface layer is dark gray silt loam about 2 inches thick. The subsurface layer is light gray silt loam about 4 inches thick. The next 2 inches is pale brown silty clay loam and light gray silt loam. The subsoil is about 22 inches thick. It is yellowish brown, firm silty clay in the upper part and light yellowish brown, firm, calcareous silty clay loam in the lower part. The underlying material to a depth of 60 inches is yellow, calcareous channery silty clay loam. In some areas the subsoil has less clay.

Typically, about 1 inch of forest litter is on the surface of the Lail soil. The surface layer is dark grayish brown silt loam about 1 inch thick. The subsurface layer is light gray silt loam about 5 inches thick. The subsoil is about 24 inches thick. It is reddish brown, very firm clay in the upper part and light red, firm, calcareous clay loam in the lower part. The underlying material to a depth of about 60 inches is light red and red, calcareous clay loam. In some areas the depth to bedrock is 40 to 60 inches.

Typically, about 1 inch of forest litter is on the surface of the Trebor soil. The surface layer is grayish brown channery silt loam about 3 inches thick. The subsoil is dark brown and yellowish brown, firm very channery and very flaggy silty clay loam about 12 inches thick. It is calcareous in the lower part. The underlying material is light gray, calcareous very flaggy loam. White limestone is at a depth of about 30 inches. In some areas the depth to bedrock is less than 20 inches. In other areas it is more than 40 inches.

Included with these soils in mapping are small areas of Heath and Redbird soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. Heath and Redbird soils have a thick, dark surface layer. They are in meadows. The Rock outcrop is in scattered areas throughout the unit.

The available water capacity is high in the Stovho and Lail soils and low in the Trebor soil. Permeability is slow in the Stovho and Lail soils and moderately slow in the Trebor soil. The shrink-swell potential is high in the subsoil of the Stovho and Lail soils and moderate in the underlying material. It is moderate in the Trebor soil. Runoff is medium on all three soils.

Most of the acreage is used for timber (fig. 8). The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 76 on the Stovho and Lail soils and 60 on the Trebor soil. Some quaking aspen, paper birch, and Black Hills spruce grow on this map unit. The understory is dominantly bearded wheatgrass, sedges, oatgrass, brome, common juniper, snowberry, Oregongrape, and bearberry.

When these soils are wet, logging activities, such as skidding, hauling, and construction, can cause surface compaction and the formation of ruts. These activities should be performed when the soils are dry or frozen. The windthrow hazard is moderate on the Trebor soil. It can be reduced by thinning and harvesting methods that do not isolate the remaining trees or leave them widely spaced.

This map unit is well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help

Figure 8.—A timbered area of Stovho-Lail-Trebor complex, 2 to 12 percent slopes.

to prevent depletion of the desirable forage species.

The Stovho and Lail soils have moderate limitations and the Trebor soil severe limitations if used as a site for dwellings with basements. The shrink-swell potential in the Stovho and Lail soils and the moderate depth to bedrock in the Trebor soil are the main limitations. Backfilling with sandy material, installing foundation drains, and diverting runoff away from the dwellings help to prevent the structural damage caused by shrinking and swelling. Reinforcing foundations and footings also helps to prevent this damage. Excavation activities are hindered on the Trebor soil because of large rock fragments and the moderate depth to bedrock.

These soils are severely limited as sites for septic tank absorption fields. The slow permeability in the Stovho and Lail soils and a thin layer of suitable material and seepage in the Trebor soil are the main limitations. Enlarging the absorption area helps to overcome the slow absorption of liquid waste in areas of the Stovho and Lail soils. Seepage of liquid waste through cracks in the bedrock can result in the pollution

of shallow ground water in the Trebor soil.

The Stovho and Lail soils have severe limitations and the Trebor soil moderate limitations if used as a site for hard-surfaced roads and streets. The shrink-swell potential, low strength in the Stovho and Lail soils, and the depth to bedrock in the Trebor soil are the main limitations. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Constructing roads on raised, well compacted fill material and diverting runoff away from roads help to prevent the damage caused by shrinking and swelling. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods. Unsurfaced roads in areas of the Trebor soil may require additions of borrow material.

The land capability classification is VIe-13, and the grazable woodland group is High Woodland.

SycE—Stovho-Trebor complex, 10 to 40 percent slopes. These well drained, strongly sloping to steep soils are on mountains at the higher elevations on the Limestone Plateau. They formed in material weathered from limestone and calcareous sandstone. The deep Stovho soil is on the mid and lower side slopes and on foot slopes. The moderately deep Trebor soil is on the upper side slopes and on ridges. Elevation ranges from 6,200 to 7,200 feet above sea level. Annual precipitation ranges from 20 to 24 inches.

Areas of this map unit are irregular in shape and are 15 to several thousand acres in size. They are 45 to 55 percent Stovho soil and 30 to 40 percent Trebor soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Stovho soil. The surface layer is dark gray silt loam about 2 inches thick. The subsurface layer is light gray silt loam about 4 inches thick. The next 2 inches is pale brown silty clay loam and light gray silt loam. The subsoil is about 22 inches thick It is yellowish brown, firm silty clay in the upper part and light yellowish brown, firm, calcareous silty clay loam in the lower part. The underlying material to a depth of about 60 inches is yellow, calcareous channery silty clay loam. In some areas the soil does not have a dark surface layer. In other areas the subsoil is reddish brown.

Typically, about 1 inch of forest litter is on the surface of the Trebor soil. The surface layer is grayish brown channery silt loam about 3 inches thick. The subsoil is dark brown and yellowish brown, firm very channery and very flaggy silty clay loam about 12 inches thick. It is calcareous in the lower part. The underlying material is light gray, calcareous very flaggy loam. White limestone is at a depth of about 30 inches. In some areas the depth to bedrock is less than 20 inches. In other areas it is at a depth of more than 40 inches.

Included with these soils in mapping are small areas of Heath and Redbird soils and areas of Rock outcrop. Inclusions make up less than 20 percent of any one mapped area. Heath and Redbird soils are in meadows. They have a surface layer that is thicker and darker than that of the Stovho and Trebor soils. The Rock outcrop is in scattered areas throughout the unit.

The available water capacity is high in the Stovho soil and low in the Trebor soil. Permeability is slow in the Stovho soil and moderately slow in the Trebor soil. The shrink-swell potential is high in the subsoil of the Stovho soil and moderate in the underlying material. It is moderate in the Trebor soil. Runoff is medium or rapid on both soils.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 76 on the Stovho soil and 60 on the Trebor soil. Some quaking aspen, paper birch, and Black Hills spruce grow in most areas. The understory is dominantly sedges, bearded wheatgrass, oatgrass, vetches, common juniper, snowberry, Oregongrape, and bearberry.

When the Stovho soil is wet, logging activities, such as skidding, hauling, and construction, can cause surface compaction and the formation of ruts. These activities should be performed when the soil is dry or frozen. Erosion can be controlled by reseeding disturbed areas and by installing water bars and culverts. Mass soil movement may occur in steep areas if the surface is disturbed. Harvesting or thinning methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard on the Trebor soil.

This map unit is well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. Because of the slope, watering facilities should be located on the Stovho soil.

These soils are severely limited as sites for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The depth to bedrock and seepage in the Trebor soil, low strength and slow permeability in the Stovho soil, and the steep slopes are the main limitations. Better suited sites generally are available. Applying gravel to unsurfaced roads

improves the traffic-supporting capacity during wet periods. Unsurfaced roads in areas of the Trebor soil may require additions of borrow material.

The land capability classification is VIIe-9, and the grazable woodland group is High Woodland.

TfA—Tilford silt loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on terraces and uplands in the Red Valley. It formed in material weathered from reddish siltstone and silty shale. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches. Areas are irregular in shape and are 10 to 60 acres in size.

Typically, the surface layer is dark brown silt loam about 5 inches thick. The subsoil is dark brown, brown, and reddish yellow, very friable silt loam about 15 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is yellowish red, calcareous silt loam. In some areas the depth to carbonates is more than 10 inches. In other areas the subsoil has more clay.

Included with this soil in mapping are small areas of Nevee soils. These soils make up less than 15 percent of any one mapped area. They contain less clay than the Tilford soil and have a lighter colored surface layer. They are on high parts of the landscape.

Fertility is medium and the content of organic matter moderate in the Tilford soil. The available water capacity is high, and permeability is moderate. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

Some areas are used as cropland. This soil is well suited to cultivated crops. Oats and alfalfa are the main crops. Conserving moisture is a management concern. Tillage practices that leave crop residue on the surface and minimum tillage conserve moisture. Returning crop residue to the soil, planting green manure crops, and regularly adding animal manure improve fertility and help to maintain the content of organic matter.

This soil is well suited to tame pasture and hay. Alfalfa, crested wheatgrass, and intermediate wheatgrass are suitable pasture plants. Proper stocking rates, rotation grazing, applications of fertilizer, and weed control help to keep the pasture in good condition.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Summer fallow before planting and continued cultivation after planting help to control grasses and weeds and conserve moisture.

This soil is slightly limited as a site for dwellings and septic tank absorption fields. It is moderately limited as a site for hard-surfaced roads and streets. Low strength is the main limitation. Frost action is a hazard. Constructing roads on well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by frost action. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

The land capability classification is IIIc-1, and the range site is Silty. The windbreak suitability group is 3.

TfB—Tilford silt loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on terraces and uplands in the Red Valley. It formed in material weathered from reddish siltstone and silty shale. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches. Areas are irregular in shape and are 10 to 150 acres in size.

Typically, the surface layer is dark brown silt loam about 5 inches thick. The subsoil is dark brown, brown, and reddish yellow, very friable silt loam about 15 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is yellowish red, calcareous silt loam. In some areas the depth to carbonates is more than 10 inches. In other areas the subsoil has more clay.

Included with this soil in mapping are small areas of Nevee soils. These soils make up less than 15 percent of any one mapped area. They contain less clay than the Tilford soil and have a lighter colored surface layer. They are on high parts of the landscape.

Fertility is medium and the content of organic matter moderate in the Tilford soil. The available water capacity is high, and permeability is moderate. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

Some areas are used as cropland. This soil is well suited to cultivated crops. Oats and alfalfa are the main crops. Conserving moisture and controlling erosion are management concerns in cultivated areas. Tillage practices that leave crop residue on the surface and

minimum tillage help to control erosion and conserve moisture. Contour farming, grassed waterways, and terraces help to control water erosion. Returning crop residue to the soil, planting green manure crops, and regularly adding animal manure improve fertility, help to maintain the content of organic matter, and control water erosion and wind erosion.

This soil is well suited to tame pasture and hay. Alfalfa, crested wheatgrass, and intermediate wheatgrass are suitable pasture plants. Proper stocking rates, rotation grazing, applications of fertilizer, and weed control help to keep the pasture in good condition.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion. Summer fallow before planting and continued cultivation after planting help to control grasses and weeds and conserve moisture.

This soil is slightly limited as a site for dwellings and septic tank absorption fields. It is moderately limited as a site for hard-surfaced roads and streets. Low strength is the main limitation. Frost action is a hazard. Constructing roads on well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by frost action. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

The land capability classification is IIIe-1, and the range site is Silty. The windbreak suitability group is 3.

TfC—Tilford silt loam, 6 to 15 percent slopes. This deep, well drained, moderately sloping and strongly sloping soil is on uplands in the Red Valley. It formed in material weathered from reddish siltstone and silty shale. Elevation ranges from 3,200 to 4,800 feet above sea level. Annual precipitation ranges from 16 to 18 inches. Areas are irregular in shape and are 10 to 80 acres in size.

Typically, the surface layer is dark brown silt loam about 5 inches thick. The subsoil is dark brown, brown, and reddish yellow, very friable silt loam about 15 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is yellowish red, calcareous silt loam. In some areas the surface layer is lighter in color. In other areas the subsoil has more clay.

Included with this soil in mapping are small areas of Gypnevee and Paunsaugunt soils. These soils make up less than 15 percent of any one mapped area. Gypnevee soils have large amounts of gypsum. They are in landscape positions similar to those of the Tilford soil. Paunsaugunt soils have limestone or calcareous sandstone at a depth of 10 to 20 inches. They are on high parts of the landscape.

Fertility is medium and the content of organic matter moderate in the Tilford soil. The available water capacity is high, and permeability is moderate. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. Controlling water erosion and conserving moisture are management concerns. Maintaining a good plant cover and ground mulch helps to prevent excessive water erosion, increases the rate of water intake, and conserves moisture. Proper stocking rates and rotation grazing help to maintain a good plant cover.

This soil is well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth brome are suitable pasture plants.

This soil is suited to cultivated crops. Oats and alfalfa are the main crops. Controlling water erosion and conserving moisture are management concerns in cultivated areas. Minimizing tillage and leaving crop residue on the surface help to control erosion, conserve moisture, and improve fertility and tilth. Contour farming, grassed waterways, and terraces help to control water erosion.

This soil is suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well, except for those that require an abundant supply of moisture. Planting on the contour helps to control erosion.

This soil is moderately limited as a site for dwellings and septic tank absorption fields. The slope is the main limitation. Designing dwellings so that they conform to the natural slope of the land helps to overcome the slope. Land shaping is needed in some areas. Land shaping and installing the distribution lines across the slope help to ensure that septic tank absorption fields on slopes of more than 8 percent function properly.

This soil is moderately limited as a site for hard-surfaced roads and streets. The slope and low strength are the main limitations. Frost action is a hazard. Constructing the roads on well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by frost action. Building the roads and streets on the contour helps to overcome the slope. Providing coarse grained subgrade or base material helps to prevent the damage caused

by low strength. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soil during wet periods.

The land capability classification is IVe-1, and the range site is Silty. The windbreak suitability group is 3.

TpC—Tilford-Paunsaugunt complex, 6 to 9 percent slopes. These well drained, moderately sloping soils are on uplands in areas of the Red Valley adjacent to the Limestone Plateau. The deep Tilford soil is on side slopes and foot slopes. It formed in material weathered from reddish siltstone and silty shale. The shallow Paunsaugunt soil is on ridges. It formed in material weathered from limestone or calcareous sandstone. Elevation ranges from 3,400 to 5,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 400 acres in size. They are 45 to 55 percent Tilford soil and 35 to 45 percent Paunsaugunt soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Tilford soil is dark brown silt loam about 5 inches thick. The subsoil is dark brown, brown, and reddish yellow, very friable silt loam about 15 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is yellowish red, calcareous silt loam. In some areas the depth to bedrock is 40 to 60 inches.

Typically, the surface layer of the Paunsaugunt soil is dark brown, calcareous gravelly loam about 2 inches thick. The subsurface layer is brown, calcareous gravelly loam about 4 inches thick. The underlying material is brown, calcareous very gravelly loam. Light brown limestone is at a depth of about 11 inches. In some areas the depth to bedrock is 20 to 40 inches. In other areas it is less than 10 inches.

Included with these soils in mapping are small areas of Nevee and Sawdust soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. The deep Nevee soils contain less clay than the Tilford and Paunsaugunt soils and have a lighter colored surface layer. They are in landscape positions similar to those of the Tilford soil. The deep Sawdust soils have rock fragments throughout. They are in landscape positions similar to those of the Paunsaugunt soil. The Rock outcrop is in small, bare, low-relief areas.

Fertility is medium and the content of organic matter moderate in the Tilford and Paunsaugunt soils. The available water capacity is high in the Tilford soil and very low in the Paunsaugunt soil. Permeability is moderate in both soils. Runoff is medium.

Most of the acreage supports native grasses and is used for grazing. The Paunsaugunt soil supports a few ponderosa pine. Generally, no major hazards or limitations affect the use of these soils for range, but conserving moisture is a management concern. Proper stocking rates and rotation grazing help to maintain an adequate ground cover, which reduces moisture loss.

The Tilford soil is poorly suited and the Paunsaugunt soil unsuited to cultivated crops and to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth brome are suitable pasture plants in areas of the Tilford soil. Alfalfa and oats are the main crops. The shallowness to bedrock prevents tillage of the Paunsaugunt soil. Measures that control erosion and conserve moisture, such as leaving crop residue on the surface, minimizing tillage, and including grasses and legumes in the cropping system, are needed in cultivated areas of the Tilford soil.

The Tilford soil is suited to windbreaks and environmental plantings, but the Paunsaugunt soil is unsuited because of the shallowness to bedrock. Most climatically suited trees grow well on the Tilford soil, except for those that require an abundant supply of moisture. Planting the trees and shrubs on the contour helps to control erosion.

Some of the acreage is used for timber. The canopy generally is sparse and is confined to the Paunsaugunt soil. The overstory is dominantly stunted ponderosa pine. Most areas of the Paunsaugunt soil support some bur oak. These soils have a limited potential for timber production. The site index for ponderosa pine is about 45 on the Paunsaugunt soil. The understory is dominantly little bluestem, sideoats grama, sedges, snowberry, chokecherry, and skunkbush sumac. The dominant shrub in the southwestern part of the survey area is mountainmahogany.

The Tilford soil has slight limitations and the Paunsaugunt soil severe limitations if used as a site for dwellings and septic tank absorption fields. The shallowness to bedrock and seepage are the main limitations in the Paunsaugunt soil. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water.

The Tilford soil has moderate limitations and the Paunsaugunt soil severe limitations if used as a site for hard-surfaced roads and streets. The shallowness to bedrock in the Paunsaugunt soil and low strength in the Tilford soil are the main limitations. Frost action is a hazard on the Tilford soil. Constructing the roads on coarse grained, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by low strength and frost

action. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods. Unsurfaced roads in areas of the Paunsaugunt soil may require additions of borrow material.

The land capability classification of the Tilford soil is IVe-1, the range site is Silty, and the windbreak suitability group is 3. The land capability classification of the Paunsaugunt soil is VIs-2, the range site is Shallow, and the windbreak suitability group is 10.

TrB—Tilford-Urban land complex, 0 to 9 percent slopes. This map unit consists of a deep, well drained, nearly level to moderately sloping Tilford soil intermingled with areas of Urban land. It includes much of the residential area in the Red Valley west of "The Gap" in Rapid City. It is on terraces and uplands. The Tilford soil formed in material weathered from reddish siltstone and silty shale. Elevation ranges from 3,200 to 3,600 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 5 to 450 acres in size. They are 50 to 60 percent Tilford soil and 25 to 35 percent Urban land. The Tilford soil and Urban land occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Tilford soil is dark brown silt loam about 5 inches thick. The subsoil is dark brown, brown, and reddish yellow, very friable silt loam about 15 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is yellowish red, calcareous silt loam. In some areas, the subsoil has more clay and carbonates are at a depth of more than 10 inches. In other areas the surface layer is not so dark.

The Urban land is in areas that have been cut, buried, compacted, or disturbed in some way and now are covered with paved parking lots, streets, or buildings. Because the landscape has been altered and the soils covered w'th urban structures, identification of the soil series is not feasible.

Included in this unit in mapping are small areas of Barnum and Gypnevee soils. These soils make up less than 15 percent of any one mapped area. Barnum soils are more stratified than the Tilford soil. They are in drainageways. Gypnevee soils have gypsum throughout. They are on the steeper parts of the landscape.

Fertility is medium and the content of organic matter moderate in the Tilford soil. The available water capacity is high, and permeability is moderate. Runoff is medium.

Most of the acreage is used for lawns, gardens, open areas, and buildings. The Tilford soil is well suited to grasses, flowers, vegetables, and trees and shrubs. All climatically adapted species grow well if the site is irrigated during dry periods.

The Tilford soil is moderately limited as a site for hard-surfaced roads and streets. Low strength is the main limitation. Frost action is a hazard. Constructing hard-surfaced roads and streets on coarse grained base or subgrade material helps to prevent the damage caused by low strength. Constructing roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by frost action.

No interpretive groups are assigned to this map unit.

TuG—Trebor-Rock outcrop complex, 40 to 80 percent slopes. This map unit consists of a moderately deep, well drained, very steep Trebor soil intermingled with areas of Rock outcrop. It is on mountains at the higher elevations on the Limestone Plateau. The Trebor soil formed in material weathered from limestone. It is on side slopes. The areas of Rock outcrop occur as rimrock ledges or peaks on ridges. They are generally less than 3 acres in size. Elevation ranges from 6,200 to 7,200 feet above sea level. Annual precipitation ranges from 20 to 24 inches.

Areas of this map unit are irregular in shape and are 10 to 700 acres in size. They are 55 to 65 percent Trebor soil and 20 to 30 percent Rock outcrop. The Trebor soil and Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Trebor soil. The surface layer is grayish brown channery silt loam about 3 inches thick. The subsoil is dark brown and yellowish brown, firm very channery and very flaggy silty clay loam about 12 inches thick. It is calcareous in the lower part. The underlying material is light gray, calcareous very flaggy loam. White limestone is at a depth of about 30 inches. In some areas the depth to bedrock is less than 20 inches. In other areas it is more than 40 inches.

Typically, the Rock outcrop consists of very pale brown to white, fractured limestone. In some areas weathering has caused rock slides below the Rock outcrop.

Included in this unit in mapping are small areas of the deep Lail and Stovho soils. These soils make up less than 15 percent of any one mapped area. They are on the less sloping parts of the landscape.

The available water capacity is low in the Trebor soil.

Permeability is moderately slow. The shrink-swell potential is moderate. Runoff is rapid.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 55. This map unit supports some Black Hills spruce, quaking aspen, and paper birch. The understory is dominantly bearded wheatgrass, sedges, brome, common juniper, Oregongrape, snowberry, and bearberry.

The very steep slopes, the Rock outcrop, and boulders restrict the use of wheeled and tracked logging equipment. When timber is harvested, a cable logging system helps to overcome the slope and control water erosion. The erosion hazard can be reduced by reseeding disturbed areas, installing water bars on skid trails, and providing culverts and rolling dips on sites for roads. Mass soil movement may occur in or above disturbed areas. Harvesting and thinning methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard on the Trebor soil.

The Trebor soil is suited to forage production for big game animals. It is poorly suited to grazing by livestock because of the slope.

This unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The very steep slopes, the depth to bedrock and seepage in the Trebor soil, and the Rock outcrop are the main limitations. Better suited sites generally are available. Constructing unsurfaced roads on the contour and in the less sloping areas helps to overcome the slope.

The land capability classification is VIIe-9 for the Trebor soil and VIIIs-1 for the Rock outcrop. No grazable woodland group is assigned.

VcE—Vanocker-Citadel complex, 10 to 40 percent slopes. These deep, well drained, strongly sloping to steep soils are on mountains at the lower elevations on the Limestone Plateau. They formed in material weathered from limestone and calcareous sandstone. The Vanocker soil is on high parts of the landscape. The Citadel soil is on low side slopes and in coves. Elevation ranges from 3,500 to 6,200 feet above sea level. Annual precipitation ranges from 18 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to 2,000 acres in size. They are 55 to 65 percent Vanocker soil and 20 to 30 percent Citadel soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Vanocker soil. The surface layer is brown channery loam about 2 inches thick. The subsoil is brown and pale brown, firm and friable very channery clay loam about 11 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is very pale brown, calcareous very channery loam. In some areas the depth to bedrock is 20 to 40 inches.

Typically, about 1 inch of forest litter is on the surface of the Citadel soil. The surface layer is dark brown loam about 1 inch thick. The subsurface layer is light reddish brown loam about 9 inches thick. The next 4 inches is light reddish brown clay and reddish brown loam. The subsoil is about 28 inches thick. It is light reddish brown, firm clay in the upper part; brown, firm clay loam in the next part; and yellowish brown, friable, calcareous gravelly clay loam in the lower part. The underlying material to a depth of about 60 inches is light yellowish brown, calcareous gravelly clay loam. In some areas the subsoil has less clay and more silt. In other areas the surface layer is thick and dark.

Included with these soils in mapping are small areas of Paunsaugunt and Sawdust soils and areas of Rock outcrop. Inclusions make up less than 20 percent of any one mapped area. Paunsaugunt soils have bedrock at a depth of 10 to 20 inches. They are on high parts of the landscape. Sawdust soils are generally on the drier aspects. They have less clay in the subsoil than the Vanocker and Citadel soils. The areas of Rock outcrop are on the mid and high parts of the landscape.

The available water capacity is moderate in the Vanocker soil and high in the Citadel soil. Permeability is moderate in the Vanocker soil and slow in the Citadel soil. The shrink-swell potential is moderate in the Vanocker soil. It is high in the subsoil of the Citadel soil and moderate in the underlying material. Runoff is medium on both soils.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 62 on the Vanocker soil and 70 on the Citadel soil. The Citadel soil supports some quaking aspen, bur oak, Black Hills spruce, and paper birch. The understory is dominantly little bluestem, brome, sedges, prairie dropseed, western wheatgrass, common juniper, Oregongrape, and snowberry.

When the Citadel soil is wet, logging activities, such as skidding, hauling, and construction, can cause surface compaction and the formation of ruts. These activities should be performed when the soil is dry or frozen. Erosion can be controlled by reseeding disturbed areas and by installing water bars and culverts. Mass soil movement can occur in steep areas if the surface is disturbed.

These soils are well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. Because of the slope and seepage, watering facilities should be located on the Citadel soil.

These soils are severely limited as sites for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. The high shrink-swell potential, slow permeability, and low strength in the Citadel soil and the slope of both soils are the main limitations. Better suited sites generally are available. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Vanocker soil is VIIe-9, and the grazable woodland group is Cool Slopes. The land capability classification of the Citadel soil is VIe-13, and the grazable woodland group is Silty Foot Slopes.

VkE—Vanocker-Lakoa complex, 10 to 40 percent slopes. These deep, well drained, strongly sloping to steep soils are on mountains at the lower elevations on the Limestone Plateau. The Vanocker soil formed in material weathered from limestone and calcareous sandstone. It is on side slopes. The Lakoa soil formed in material weathered from sandstone. It is on foot slopes. Elevation ranges from 3,500 to 6,200 feet above sea level. Annual precipitation is 18 to 22 inches.

Areas of this map unit are irregular in shape and are 10 to 2,600 acres in size. They are 50 to 60 percent Vanocker soil and 25 to 35 percent Lakoa soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Vanocker soil. The surface layer is brown channery loam about 2 inches thick. The subsoil is brown and pale brown, firm and friable very channery clay loam about 11 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is very pale brown, calcareous very channery loam. In some areas the depth to bedrock is 20 to 40 inches.

Typically, about 1 inch of forest litter is on the surface of the Lakoa soil. The surface layer is gray very fine sandy loam about 5 inches thick. The next layer is yellowish brown clay loam and pale brown sandy loam about 6 inches thick. The subsoil is yellowish brown, light yellowish brown, and pale brown, firm and friable clay loam about 22 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is very pale brown, calcareous gravelly clay loam. In some areas the subsoil is redder. In other areas it has more silt and less sand.

Included with these soils in mapping are small areas of Citadel, Paunsaugunt, and Sawdust soils and areas of Rock outcrop. Inclusions make up less than 20 percent of any one mapped area. Citadel soils are on low parts of the landscape. They have less sand and more clay than the Vanocker and Lakoa soils. Paunsaugunt soils have bedrock at a depth of 10 to 20 inches. They are on high parts of the landscape. Sawdust soils have less clay in the subsoil than the Vanocker and Lakoa soils. They are on mid and high parts of the landscape that have a south aspect. The areas of Rock outcrop are generally on high parts of the landscape near ridges.

The available water capacity is moderate in the Vanocker soil and high in the Lakoa soil. Permeability is moderate in both soils. The shrink-swell potential also is moderate. Runoff is medium.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 62 on the Vanocker soil and 70 on the Lakoa soil. This map unit supports some quaking aspen, Black Hills spruce, and paper birch. Bur oak grows on the Lakoa soil in the eastern part of the survey area. The understory is dominantly little bluestem, brome, sedges, needlegrass, oatgrass, common juniper, snowberry, and Oregongrape.

When the Lakoa soil is wet, logging activities, such as skidding, hauling, and construction, can cause surface compaction and the formation of ruts. These activities should be performed when the soil is dry or frozen. Erosion can be controlled by reseeding disturbed areas and by installing water bars and culverts. Mass soil movement can occur in steep areas if the surface is disturbed.

These soils are well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. Because of the slope and seepage, watering facilities should be located on the Lakoa soil.

These soils are severely limited as sites for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. Low strength in the Lakoa soil and the slope of both soils are the main limitations. Better suited sites generally are available. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Vanocker soil is VIIe-9, and the grazable woodland group is Cool

Slopes. The land capability classification of the Lakoa soil is VIe-13, and the grazable woodland group is Silty Foot Slopes.

VnC—Vanocker-Paunsaugunt complex, 2 to 15 percent slopes. These well drained, gently sloping to strongly sloping soils are on narrow ridges and mountain side slopes at the lower elevations on the Limestone Plateau. They formed in material weathered from limestone and calcareous sandstone. The deep Vanocker soil is on side slopes. The shallow Paunsaugunt soil is on ridges. Elevation ranges from 3,500 to 6,200 feet above sea level. Annual precipitation ranges from 16 to 20 inches.

Areas of this map unit are irregular in shape and are 10 to 1,000 acres in size. They are 50 to 60 percent Vanocker soil and 25 to 35 percent Paunsaugunt soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Vanocker soil. The surface layer is brown channery loam about 2 inches thick. The subsoil is brown and pale brown, friable and firm very channery clay loam about 11 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is very pale brown, calcareous very channery loam. In some areas the depth to bedrock is 20 to 40 inches.

Typically, the surface layer of the Paunsaugunt soil is dark brown, calcareous gravelly loam about 2 inches thick. The subsurface layer is brown, calcareous gravelly loam about 4 inches thick. The underlying material is brown, calcareous very gravelly loam. Light brown limestone is at a depth of about 11 inches. In some areas the depth to bedrock is 20 to 40 inches. In other areas it is less than 10 inches.

Included with these soils in mapping are small areas of Citadel, Gurney, and Lakoa soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. Citadel and Lakoa soils are in slight depressions. They have more clay and fewer coarse fragments than the Vanocker and Paunsaugunt soils. Gurney soils have bedrock at a depth of 20 to 40 inches. They are in meadows. The areas of Rock outcrop are flat slabs on ridges and occur as low-relief ledges on the steeper parts of the landscape.

Permeability is moderate in the Vanocker and Paunsaugunt soils. The available water capacity is moderate in the Vanocker soil and very low in the Paunsaugunt soil. The shrink-swell potential is moderate in the Vanocker soil and low in the Paunsaugunt soil. Runoff is medium on both soils.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 62 on the Vanocker soil and 45 on the Paunsaugunt soil. The understory is dominantly little bluestem, sideoats grama, sedges, common juniper, snowberry, and Saskatoon serviceberry. Harvesting and thinning methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard on the Paunsaugunt soil.

These soils are well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. The number of sites for watering facilities is limited.

The Vanocker soil has moderate limitations and the Paunsaugunt soil severe limitations if used as a site for dwellings. The slope and high shrink-swell potential of the Vanocker soil and the depth to bedrock in the Paunsaugunt soil are the main limitations. Designing dwellings so that they conform to the natural slope of the land minimizes the amount of land shaping needed to overcome the slope. Backfilling with sandy material, installing foundation drains, and diverting runoff away from the dwellings help to prevent the structural damage caused by shrinking and swelling of the Vanocker soil. Construction activities are hindered on the Paunsaugunt soil because of the shallowness to bedrock.

The Vanocker soil has moderate limitations and the Paunsaugunt soil severe limitations if used as a site for septic tank absorption fields. The slope and moderate permeability in the Vanocker soil and a thin layer of suitable material and seepage in the Paunsaugunt soil are the main limitations. Enlarging the absorption area helps to overcome the slow absorption of liquid waste in the Vanocker soil. Installing the distribution lines across the slope or in the less sloping areas helps to overcome slope. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water in the Paunsaugunt soil.

The Vanocker soil has moderate limitations and the Paunsaugunt soil severe limitations if used as a site for hard-surfaced roads and streets. The slope and moderate shrink-swell potential of the Vanocker soil and the depth to bedrock in the Paunsaugunt soil are the main limitations. Frost action is a hazard on the Vanocker soil. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts minimize the damage caused by shrinking and swelling and by frost action. Building the

roads on the contour helps to overcome the slope. Applying borrow material to unsurfaced roads in areas of the Paunsaugunt soil improves the traffic-supporting capacity.

The land capability classification of the Vanocker soil is VIe-13, and the grazable woodland group is Cool Slopes. The land capability classification of the Paunsaugunt soil is VIIs-1, and the grazable woodland group is Shallow Ridge.

VoG—Vanocker-Sawdust-Rock outcrop complex, 40 to 80 percent slopes. This map unit consists of deep, well drained, very steep Vanocker and Sawdust soils intermingled with areas of Rock outcrop. It is on the sides of mountains and canyons at the lower elevations on the Limestone Plateau. The Vanocker and Sawdust soils formed in material weathered from limestone and calcareous sandstone. They are on side slopes. The Vanocker soil is on north-facing slopes, and the Sawdust soil is on south-facing slopes. The areas of Rock outcrop are generally on ridges and are less than 3 acres in size. Elevation ranges from 3,500 to 6,200 feet above sea level. Annual precipitation ranges from 18 to 20 inches.

Areas of this map unit are long and narrow and are 10 to 1,500 acres in size. They are 40 to 50 percent Vanocker soil, 25 to 35 percent Sawdust soil, and 10 to 20 percent Rock outcrop. The two soils and the Rock outcrop occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Vanocker soil. The surface layer is brown channery loam about 2 inches thick. The subsoil is brown and pale brown, friable and firm very channery clay loam about 11 inches thick. It is calcareous in the lower part. The underlying material to a depth of about 60 inches is very pale brown, calcareous very channery loam. In some areas the depth to bedrock is 20 to 40 inches.

Typically, the surface layer of the Sawdust soil is dark grayish brown, calcareous channery loam about 4 inches thick. The next layer is pale brown, friable, calcareous very channery loam about 4 inches thick. The upper part of the underlying material is light yellowish brown, calcareous very channery loam. The next part is very pale brown, calcareous extremely channery loam. The lower part to a depth of about 60 inches is yellow, calcareous extremely channery sandy loam. In some areas the soil has more sand and less clay. In other areas bedrock is at a depth of 20 to 40 inches.

The Rock outcrop is pale brown, hard, fractured limestone and reddish and yellowish, hard sandstone. It occurs as large, discontinuous ledges or blocks. In some areas weathering has caused rock slides below the Rock outcrop.

Included in this unit in mapping are small areas of Citadel, Paunsaugunt, and Winetti soils. These soils make up less than 20 percent of any one mapped area. Citadel soils have more clay in the subsoil than the Vanocker and Sawdust soils. They are on low parts of the landscape. Paunsaugunt soils have bedrock at a depth of 10 to 20 inches. They are generally adjacent to the Rock outcrop. Winetti soils are along drainageways. They are more stratified than the Vanocker and Sawdust soils.

The available water capacity is moderate in the Vanocker and Sawdust soils. Permeability also is moderate. The shrink-swell potential is moderate in the Vanocker soil and low in the Sawdust soil. Runoff is rapid on both soils.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 58 on the Vanocker soil and 45 on the Sawdust soil. The understory is dominantly little bluestem, sedges, sideoats grama, common juniper, snowberry, Saskatoon snowberry, and yucca.

The very steep slopes and the Rock outcrop restrict the use of wheeled and tracked logging equipment. When timber is harvested, a cable logging system helps to overcome the slope and control water erosion. Water erosion can be controlled by reseeding disturbed areas, installing water bars on skid trails, and providing culverts and rolling dips on sites for roads. Mass soil movement may occur in or above disturbed areas.

This map unit is poorly suited to livestock grazing because of the slope.

This map unit is severely limited as a site for dwellings, septic tank absorption fields, and hard-surfaced roads and streets. Large stones on the Sawdust soil, the slope, and the Rock outcrop are the main limitations. Better suited sites generally are available. Constructing unsurfaced roads on the contour and in the less sloping areas helps to overcome the slope.

The land capability classification is VIIe-9 for the Vanocker and Sawdust soils and VIIIs-1 for the Rock outcrop. No grazable woodland group is assigned.

VpC—Virkula-Pactola complex, 2 to 15 percent slopes. These deep, well drained, gently sloping to rolling soils are on broad ridgetops and mountain side slopes in the Central Crystalline Area. They formed in material weathered from steeply tilted metamorphic

rock. The Virkula soil is on foot slopes and mid and low side slopes. The Pactola soil is on ridges. Elevation ranges from 4,000 to 6,200 feet above sea level. Annual precipitation ranges from 18 to 22 inches.

Areas of this map unit are irregular in shape and are 10 to 650 acres in size. They are 45 to 55 percent Virkula soil and 25 to 35 percent Pactola soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, about 1 inch of forest litter is on the surface of the Virkula soil. The surface layer is grayish brown loam about 1 inch thick. The subsurface layer is light gray loam about 12 inches thick. The next 9 inches is pale brown silty clay loam and light gray loam. The subsoil is light yellowish brown, firm silty clay loam about 23 inches thick. The underlying material to a depth of about 60 inches is light yellowish brown channery and very channery silty clay loam. In some areas the depth to bedrock is 20 to 60 inches. In other areas the subsoil has more channers.

Typically, about 1 inch of forest litter is on the surface of the Pactola soil. The surface layer is dark gray channery loam about 1 inch thick. The subsurface layer is very pale brown channery loam about 10 inches thick. The next 7 inches is pale brown very channery clay loam and very pale brown channery loam. The subsoil is yellowish brown, firm extremely channery clay loam. Grayish brown, steeply tilted, fractured metamorphic rock is at a depth of about 42 inches. In some areas the depth to bedrock is 20 to 40 inches. In other areas the subsoil has more mica.

Included with these soils in mapping are small areas of Cordeston, Heely, and Mocmont soils, soils that are less than 20 inches deep over bedrock, and areas of Rock outcrop. Inclusions make up less than 20 percent of any one mapped area. Cordeston soils are along drainageways. They have fewer rock fragments than the Virkula and Pactola soils and are dark to a depth of more than 16 inches. Heely and Mocmont soils are in landscape positions similar to those of the Pactola soil. Heely soils have a surface layer that is darker than that of the Pactola soil. Mocmont soils formed in material weathered from granite. The soils that are less than 20 inches over bedrock and the Rock outcrop are on high parts of the landscape.

The available water capacity is high in the Virkula soil and low in the Pactola soil. Permeability is moderately slow in the Virkula soil and moderate in the Pactola soil. The shrink-swell potential is moderate in both soils. Runoff is medium.

Most of the acreage is used for timber. The overstory is dominantly ponderosa pine. The site index for ponderosa pine is about 72 on the Virkula soil and 60 on the Pactola soil. Most areas support some quaking aspen, paper birch, and Black Hills spruce. Bur oak grows on the Virkula soil at the lower elevations in the eastern part of the survey area. The understory is dominantly prairie dropseed, western wheatgrass, needlegrass, sedges, russet buffaloberry, snowberry, chokecherry, and leadplant.

When the Virkula soil is wet, logging activities, such as skidding, hauling, and construction, can cause surface compaction and the formation of ruts. These activities should be performed when the soil is dry or frozen. Construction activities are hindered in areas of the Pactola soil because of the large rock fragments. Harvesting and thinning methods that do not isolate the remaining trees or leave them widely spaced help to overcome the windthrow hazard on the Pactola soil.

This map unit is well suited to the production of forage for livestock and big game animals. Proper stocking rates and a uniform distribution of grazing help to prevent depletion of the desirable forage species. The Virkula soil is better suited to livestock watering facilities than the Pactola soil.

The Virkula soil has moderate limitations and the Pactola soil severe limitations if used as a site for dwellings. The slope and shrink-swell potential of the Virkula soil and the large stones in the Pactola soil are the main limitations. Construction activities are hindered on the Pactola soil because of the numerous rock fragments and the depth to bedrock. Designing dwellings so that they conform to the natural slope of the land minimizes the amount of land shaping needed to overcome the slope. Backfilling with sandy material, installing foundation drains, and diverting runoff away from the dwellings help to prevent the structural damage caused by shrinking and swelling of the Virkula soil. Reinforcing foundation and footings also helps to prevent this damage.

These soils are severely limited as sites for septic tank absorption fields and hard-surfaced roads and streets. The moderately slow permeability and low strength in the Virkula soil and the large stones in the Pactola soil are the main limitations. Enlarging the absorption area in the septic tank absorption fields helps overcome the slow absorption of liquid waste in the Virkula soil. The installation of septic tank absorption fields and the construction of hard-surfaced roads and streets on the Pactola soil are hindered by the numerous large stones. Constructing hard-surfaced roads and streets on coarse grained subgrade or base material helps to prevent the damage caused by low strength in the Virkula soil. Applying gravel to

unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification is VIe-13. The grazable woodland group is Silty Foot Slopes for the Virkula soil and Rocky Side Slopes for the Pactola soil.

WtB—Winetti cobbly loam, 2 to 10 percent slopes. This deep, rarely flooded, somewhat excessively drained, gently sloping and moderately sloping soil is on flood plains in the Red Valley and at the lower elevations on the Limestone Plateau. It is dissected by major meandering streams. It formed in alluvium derived from sedimentary rock. Elevation ranges from 3,200 to 5,000 feet above sea level. Annual precipitation ranges from 17 to 20 inches. Areas are long and narrow and are 10 to 150 acres in size.

Typically, the surface layer is grayish brown, calcareous cobbly loam about 5 inches thick. The upper part of the underlying material is brown, calcareous loamy sand. The lower part to a depth of about 60 inches is grayish brown, calcareous very gravelly and very cobbly sandy loam. In some areas the soil is not calcareous.

Included with this soil in mapping are small areas of Barnum and Colombo soils. These soils make up less than 15 percent of any one mapped area. They have fewer coarse fragments than the Winetti soil. They are generally in the less sloping areas away from channels. Also included are some areas where stones and boulders cover as much as 25 percent of the surface.

Fertility is medium and the content of organic matter moderate in the Winetti soil. The available water capacity is low, and permeability is moderately rapid. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing. Some areas at higher elevations support a thin stand of ponderosa pine. Some areas at the lower elevations support a stand of hardwoods, such as green ash, cottonwood, and ironwood. Generally, no major hazards or limitations affect the use of this soil for range. Proper stocking rates and rotation grazing help to maintain maximum productivity.

This soil is unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. The large amount of cobbles throughout the profile is the main limitation.

This soil is severely limited as a site for dwellings. Flooding is the main hazard. The dwellings should be built on the adjacent upland soils. The sides of shallow excavations can cave in unless they are shored.

This soil is moderately limited as a site for septic tank absorption fields and hard-surfaced roads and streets. Flooding and frost action are the main hazards. Septic tank absorption fields should be located on the adjacent upland soils. Constructing roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by flooding and by frost action.

The land capability classification is VIs-4, and the range site is Overflow. The windbreak suitability group is 10.

ZcC—Zigweid-Canyon complex, 2 to 15 percent slopes. These well drained, gently sloping to strongly sloping soils are on uplands. They formed in loamy material weathered from interbedded sandstone and limestone. The deep Zigweid soil is on the less sloping parts of the landscape. The shallow Canyon soil is on the steeper side slopes and ridges. Elevation ranges from 3,400 to 5,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of these soils are irregular in shape and are 15 to 800 acres in size. They are 55 to 65 percent Zigweid soil and 20 to 30 percent Canyon soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Zigweid soil is brown clay loam about 2 inches thick. The subsurface layer is pale brown, calcareous clay loam about 2 inches thick. The subsoil is pale brown and gray, friable, calcareous clay loam about 16 inches thick. The underlying material to a depth of about 60 inches is light gray, calcareous clay loam. In some areas the surface layer and underlying material have less clay. In other areas the depth to bedrock is 20 to 40 inches.

Typically, the Canyon soil has a surface layer of brown, calcareous loam about 4 inches thick. The next layer is very pale brown, friable, calcareous gravelly loam about 6 inches thick. The underlying material is very pale brown, calcareous gravelly loam about 8 inches thick. Light gray, calcareous, soft, interbedded fine grained sandstone and fractured limestone are at a depth of about 18 inches. In some areas the soil is not calcareous.

Included with these soils in mapping are small areas of Nihill, Norrest, and Satanta soils and areas of Rock outcrop. Inclusions make up less than 15 percent of any one mapped area. The deep Nihill soils contain more gravel than the Zigweid soil. They are in landscape positions similar to those of the Canyon soil. The deep Satanta soils are deeper to carbonates than the Zigweid soil. They are in landscape positions similar to those of the Zigweid soil. The moderately deep Norrest soils have more clay than the Zigweid soil. They are in

swales. The Rock outcrop is sandstone, limestone, or shale. It is on high parts of the landscape.

Fertility and the content of organic matter are low in the Zigweid and Canyon soils. The available water capacity is high in the Zigweid soil and very low in the Canyon soil. Permeability is moderate in both soils. The shrink-swell potential is moderate in the Zigweid soil and low in the Canyon soil. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Proper stocking rates and rotation grazing help to maintain maximum productivity and control erosion.

These soils generally are unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. The low fertility of both soils and the shallowness to bedrock in the Canyon soil are the main limitations. Water erosion is a hazard.

These soils are moderately limited as sites for dwellings. The slope and the moderate shrink-swell potential of the Zigweid soil are the main limitations. Diverting runoff away from the dwellings and reinforcing foundations and footings help to prevent the structural damage caused by shrinking and swelling of the Zigweid soil. Designing dwellings so that they conform to the natural slope of the land helps to overcome the slope. Land shaping is needed in some areas.

The Zigweid soil has moderate limitations and the Canyon soil severe limitations if used as a site for septic tank absorption fields. The slope and moderate permeability in areas of the Zigweid soil and a thin layer of suitable material and seepage in the Canyon soil are the main limitations. Enlarging the absorption area helps to overcome the slow absorption of liquid waste in the Zigweid soil. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly. Seepage of liquid waste through cracks in the bedrock can result in the pollution of shallow ground water in the Canyon soil.

These soils are moderately limited as sites for hard-surfaced roads and streets. Low strength and the moderate shrink-swell potential of the Zigweid soil and the slope of both soils are the main limitations. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength and by shrinking and swelling. Building the roads and streets on the contour helps to overcome the slope. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification of the Zigweid soil is VIe-1, the range site is Thin Upland, and the windbreak suitability group is 8. The land capability classification of the Canyon soil is VIe-11, the range site is Shallow, and the windbreak suitability group is 10.

ZnD—Zigweid-Nihill complex, 6 to 15 percent slopes. These deep, well drained, moderately sloping and rolling soils are on ridges and side slopes on old terraces. They are in the Red Valley and at the lower elevations on the Limestone Plateau. They formed in loamy and gravelly alluvium. The Zigweid soil is on side slopes. The Nihill soil is on ridges. Elevation ranges from 3,200 to 5,000 feet above sea level. Annual precipitation ranges from 16 to 18 inches.

Areas of this map unit are irregular in shape and are 10 to 500 acres in size. They are 45 to 55 percent Zigweid soil and 30 to 40 percent Nihill soil. The two soils occur as areas so closely intermingled or so small that mapping them separately was not practical.

Typically, the surface layer of the Zigweid soil is dark brown clay loam about 2 inches thick. The subsurface layer is pale brown, calcareous clay loam about 2 inches thick. The subsoil is pale brown and light gray, friable, calcareous clay loam about 16 inches thick. The underlying material to a depth of about 60 inches is light gray, calcareous clay loam. In some areas the soil has less clay throughout. In other areas the depth to bedrock is 20 to 40 inches.

Typically, the surface layer of the Nihill soil is grayish brown, calcareous gravelly loam about 3 inches thick. The next layer is light brownish gray, friable, calcareous gravelly loam about 4 inches thick. The underlying material to a depth of about 60 inches is very pale brown, calcareous very gravelly loam. In some areas the soil is redder.

Included with these soils in mapping are small areas of Hilger and Satanta soils. These included soils make up less than 10 percent of any one mapped area. Hilger soils have more clay in the subsoil than the Zigweid and Nihill soils. They are in landscape positions similar to those of the Nihill soil. Satanta soils have a thick, dark surface layer and a well developed subsoil. They are in landscape positions similar to those of the Zigweid soil.

Fertility and the content of organic matter are low in the Zigweid and Nihill soils. The available water capacity is high in the Zigweid soil and low in the Nihill soil. Permeability is moderate in the Zigweid soil and moderately rapid in the Nihill soil. The shrink-swell potential is moderate in the Zigweid soil and low in the Nihill soil. Runoff is medium on both soils.

Most of the acreage supports native grasses and is

used for grazing. Some areas support sparse stands of ponderosa pine. Water erosion is a hazard unless an adequate plant cover is maintained. Reestablishing vegetation is difficult in denuded areas. Proper stocking rates and rotation grazing help to maintain maximum productivity and control erosion.

These soils generally are unsuited to cultivated crops, to tame pasture and hay, and to windbreaks and environmental plantings. The slope and low fertility of both soils and the gravel throughout the Nihill soil are the main limitations. Water erosion and drought are hazards.

This unit is moderately limited as a site for dwellings. The slope of both soils and the moderate shrink-swell potential of the Zigweid soil are the main limitations. Diverting runoff away from the dwellings and reinforcing foundations and footings help to prevent the structural damage caused by shrinking and swelling of the Zigweid soil. Designing dwellings so that they conform to the natural slope of the land helps to overcome the slope. Land shaping is needed in some areas.

These soils are moderately limited as sites for septic tank absorption fields. The slope of both soils and the moderate permeability in the Zigweid soil are the main limitations. Enlarging the absorption area helps to overcome the slow absorption of liquid waste in the Zigweid soil. Land shaping and installing the distribution lines across the slope help to ensure that the absorption fields function properly.

These soils are moderately limited as sites for hard-surfaced roads and streets. The slope, low strength, and the moderate shrink-swell potential of the Zigweid soil are the main limitations. Frost action is a hazard on the Nihill soil. Building the roads and streets on the contour helps to overcome the slope. Providing coarse grained subgrade or base material helps to prevent the damage caused by low strength. Constructing the roads on raised, well compacted fill material and providing adequate roadside ditches and culverts help to prevent the damage caused by shrinking and swelling and by frost action. Applying gravel to unsurfaced roads improves the traffic-supporting capacity of the soils during wet periods.

The land capability classification is VIe-1 for the Zigweid soil and VIe-5 for the Nihill soil. The range site of both soils is Thin Upland. The windbreak suitability group is 8.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help to prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of the survey.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Only a small percent of the acreage in this survey area is used for cultivated crops or for tame pasture and hay. The major crops are oats and alfalfa. Corn and sorghum are grown for grain and silage on a limited basis. Alfalfa, intermediate wheatgrass, smooth brome, and crested wheatgrass are grown as tame pasture plants. A short growing season limits crop maturity in some years.

This survey area has no prime farmland. The potential of the soils for increased crop production is slight. Crop production could be increased by extending the latest crop production technology to all of the cropland in the survey area. This soil survey can greatly facilitate the application of such technology. The paragraphs that follow describe concerns in managing the cropland in the survey area.

Water erosion reduces productivity and results in sedimentation. It is a hazard on Bullflat, Satanta, Tilford, and other soils if the slope is more than 2 percent. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is incorporated into

the plow layer. Loss of the surface layer is especially damaging on soils that have a thin surface layer, such as Metre, Nevee, and Norrest soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Glenberg and Gurney soils. When erosion occurs, sediments rich in nutrients enter streams, lakes, and reservoirs. Control of erosion minimizes this pollution and improves the quality of water for fish and wildlife and for recreation uses. Measures that control erosion also reduce the amount of fertilizer needed in cropped areas by preventing the removal of plant nutrients from the soil.

A cropping system that keeps a plant cover on the surface for extended periods can keep soil losses to an amount that does not reduce the productive capacity of the soils. If a plant cover cannot protect the soil, careful management of crop residue is essential. Minimizing tillage and leaving crop residue on the surface increase the infiltration rate, reduce the runoff rate, and help to control erosion.

Terraces and diversions help to control erosion by shortening the length of slopes and reducing the runoff rate. They are most practical on deep, well drained soils that have long, smooth slopes, such as Bullflat, Satanta, and Tilford soils. Some of the soils in the survey area are poorly suited to terraces because of short, irregular slopes and an unfavorable subsoil, which would be exposed in terrace channels. Grassed waterways are effective in controlling gully erosion.

Wind erosion is a slight or moderate hazard on many of the soils in the survey area. The hazard is severe on Metre, Norrest, and Glenberg soils. Wind erosion can damage these soils in just a few hours if winds are strong and the soils are dry and are not protected by a plant cover or surface mulch. Wind erosion can be controlled by an adequate cover of plants or crop residue, stripcropping, and tillage methods that keep the surface rough. Windbreaks of suitable trees and shrubs also are effective in controlling wind erosion.

Information about the measures that control erosion on each kind of soil is contained in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Soil fertility helps to determine the yields that can be obtained from the soil. Yields can be improved by applying fertilizer and by including grasses and legumes in the cropping system. The kinds and amounts of fertilizer needed on soils that have a high content of lime in the surface layer generally differ from the kinds and amounts needed on soils that do not have lime in the surface layer. Applications of fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer needed.

Soil tilth is an important factor affecting seed germination and the infiltration of water into the soil. Soils with good tilth are granular and porous. Tilth is poor in Metre, Norrest, and Pierre soils. Tilth also is poor in soils that have a claypan subsoil, such as Arvada and Demar soils. These soils dry out slowly in the spring and cannot be easily tilled when dry. If they are farmed when wet, they tend to be very cloddy. Because of the cloddiness, preparing a seedbed is difficult. Timely tillage, a cropping system that includes grasses and legumes, and incorporation of crop residue into the soil improve tilth and increase the rate of water infiltration.

Overgrazing is a management concern in pastured areas. If the pasture is overgrazed, the grasses lose vigor and die and usually are replaced by annual grasses and weeds. Proper stocking rates, timely deferment of grazing, and applications of fertilizer help to keep the pasture in good condition. Bunch grasses, such as crested wheatgrass, should not be planted in areas where the slope is more than 6 percent.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is

developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations on sites for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(10)*. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations or hazards that restrict their use.

Class II soils have moderate limitations or hazards that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations or hazards that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations or hazards that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations or hazards that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations or hazards that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIIe-1 or VIe-13.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the section "Interpretive Groups."

Rangeland

Rod Baumberger, range conservationist, Soil Conservation Service, prepared this section.

About 27 percent of this survey area was range before the first permanent settlers arrived. The rest was forest. Approximately 98 percent of the survey area currently supports native vegetation which includes grasses, trees, shrubs, and forbs.

Range is land on which the native vegetation consists mainly of grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes areas where the native vegetation has been reestablished. The amount and kind of native vegetation grown in any one area is determined by soil, topography, climate, past use, and management.

Forest is land on which the native vegetation consists mainly of ponderosa pine, paper birch, quaking aspen, and bur oak and an understory of vegetation that can

be grazed or browsed. The potential native vegetation on this land is trees.

The survey area includes portions of the mixed-grass prairie, foothills area, and Black Hills pine forest *(3)*. The native vegetation on the mixed-grass prairie is dominated by mid and short grasses and some forbs. Some tall grasses are mixed in with these plants. The mixed-grass prairie is made up of cool- and warm-season species that provide good forage throughout the growing season.

The foothills area is a pine-savannah association. It consists of a dense prairie that has scattered ponderosa pine and deciduous trees in the drainageways. If the area is well managed, little bluestem, big bluestem, prairie dropseed, stonyhills muhly, blue grama, hairy grama, sideoats grama, switchgrass, indiangrass, forbs, and leadplant are abundant. Deterioration of the plant community results in varied responses, such as increases in the abundance of Kentucky bluegrass, woolly verbena, velvet mullein, broom snakeweed, and fringed sagewort.

The Black Hills pine forest has dense to open stands of ponderosa pine with a mixture of understory vegetation. The ponderosa pine is in dense stands that include some paper birch or quaking aspen. The understory consists of kinnikinnick, snowberry, chokecherry, and other shrubs interspersed with grasses and forbs. Quaking aspen and willow grow in meadows in many areas.

The production of native vegetation in some parts of the survey area is low because of the invasion of ponderosa pine, a poor distribution of grazing, and overstocking. Many of the tall grasses and some of the mid grasses have been replaced by short grasses. As a result, the total amount of available forage has been reduced. The original high-quality plants can be reestablished in the mixed prairie and savannah associations if proper grazing management is applied. Forage production can be increased in the ponderosa pine forest by thinning the trees and applying proper grazing management.

Range Sites and Condition Classes

Different kinds of soil vary in their capacity to produce native vegetation. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and the seasonal high water table also are important factors. Soils that produce about the same kinds, amounts, and proportions of native vegetation are grouped into a range site.

Each range site has a distinctive potential plant community that is referred to as the climax vegetation. The climax vegetation is relatively stable and indicates what the range site is capable of producing. It reproduces itself annually and changes very little as long as the environment remains unchanged. It consists of the plants that were growing when the region was settled.

When the site is grazed, some of the climax vegetation decreases in extent and some of it increases. Also, other plants invade the site.

Decreasers are plants that decline in quantity under close, continuous grazing. They generally are the tallest and most productive grasses and forbs and are the most palatable to livestock.

Increasers are plants that respond to growing pressure, at least initially, by increasing in quantity at the expense of the decreaser species. They generally are the shorter plants or the ones less palatable to livestock.

Invaders are plants that are not included in the climax plant community but invade the site after the extent of the climax vegetation has been reduced by some kind of disturbance or by continued overgrazing. Most invader species have little value as grazing plants. Because plants do not respond in the same manner to different influences, a plant may be a decreaser on some range sites but an increaser on others.

Table 6 shows, for many soils, the range site and the potential annual production of vegetation in favorable, average, and unfavorable years. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map.

Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the

temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. The range site is in *excellent* condition if 76 to 100 percent of the present vegetation is the same kind as the potential native vegetation; in *good* condition if the percentage is 51 to 75 percent; in *fair* condition if the percentage is 26 to 50 percent; and in *poor* condition if the percentage is 25 percent or less.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat and water areas, and protects soil and water resources.

Measures that maintain or improve the range condition are needed on all the range in the county. Proper stocking rates and planned grazing programs that include the proper sequence of grazing and prescribed rest periods help to maintain or improve the vigor of the key forage plants. Other measures are range seeding, fencing, properly located watering facilities, and mechanical treatment, such as furrowing, pitting, and deep chiseling.

A total of 18 range sites are recognized in the survey area. They are Clayey, Claypan, High Country Overflow, High Country Shallow, High Country Silty, Loamy Terrace, Mountain Prairie, Overflow, Saline Lowland, Sandy, Savannah, Shallow, Shallow Clay, Silty, Stony Hills, Subirrigated, Thin Claypan, and Thin Upland. The paragraphs that follow describe these range sites.

Clayey range site. The potential native vegetation on this site is mid and short prairie grasses interspersed with a variety of forbs and shrubs. Green needlegrass and western wheatgrass make up about 70 percent of the vegetation. Warm-season grasses make up about 25 percent. They include blue grama, buffalograss, and sideoats grama. Forbs, such as heath aster, prairie coneflower, yarrow, sagewort, false-boneset, and scarlet globemallow, make up the remainder.

The major management concern on this site is maintaining the extent of the most productive grasses. Green needlegrass, sideoats grama, and western wheatgrass lose their productive capacity after continued overgrazing because the livestock prefer these plants. If overgrazing continues, these plants are replaced by blue grama and buffalograss. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Claypan range site. The potential native vegetation on this site is a mixture of mid and short grasses. Western wheatgrass, needleandthread, and green needlegrass make up about 55 percent of the vegetation. Western wheatgrass is the dominant cool-season grass, but needleandthread may dominate in areas where the surface layer is fine sandy loam. Warm-season grasses, such as blue grama, buffalograss, and sideoats grama make up about 25 percent of the vegetation. Sedges, forbs, and big sagebrush make up the remainder.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing, needlegrass, western wheatgrass, needleandthread, and sideoats grama decrease in extent and blue grama, buffalograss, and forbs increase. The result is low forage production. If overgrazing continues, much of the surface is bare, especially during droughty periods. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants. Restricted grazing during wet periods helps to prevent surface compaction and the deterioration of tilth.

High Country Overflow range site. The potential native vegetation on this site is warm- and cool-season grasses. Western wheatgrass, bearded wheatgrass, and needlegrasses are the dominant cool-season grasses, which make up about 80 percent of the vegetation.

Prairie dropseed, the main warm-season grass, makes up about 10 percent. Forbs, such as prairiesmoke, geranium, and pussytoes, make up the remainder. In some areas the vegetation includes quaking aspen, ponderosa pine, and Black Hills spruce.

The major management concern on this site is maintaining the extent of wheatgrasses and needlegrasses. After continued overgrazing, these grasses decrease in extent and Kentucky bluegrass, sedges, and forbs increase. To ensure plant vigor, grazing should be delayed until the soil has warmed sufficiently in the spring and the forage species have achieved adequate growth. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

High Country Shallow range site. The potential native vegetation on this site is cool-season grasses, which make up about 60 percent of the vegetation. Prairie junegrass, bearded wheatgrass, and needlegrasses are the major cool-season grasses. Warm-season grasses, such as muhly and prairie dropseed, make up about 20 percent. Sedges and forbs, such as prairiesmoke, yarrow, pussytoes, and bedstraw, make up the remainder.

The major management concern on this site is maintaining the extent of bearded wheatgrass, prairie junegrass, and needlegrasses. After continued overgrazing, these grasses decrease in extent and Kentucky bluegrass, sedges, and forbs increase. To ensure plant vigor, grazing should be delayed until the soil has warmed sufficiently in the spring and the forage species have achieved adequate growth. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

High Country Silty range site. The potential native vegetation on this site is cool-season grasses, which make up about 80 percent of the vegetation. Bearded wheatgrass, western wheatgrass, Columbia needlegrass, and green needlegrass are the major cool-season grasses. Prairie dropseed, the major warm-season grass, makes up about 5 percent. Forbs and shrubs, such as prairiesmoke, sagewort, yarrow, and potentilla, make up the remainder.

The major management concern on this site is maintaining the extent of wheatgrasses and needlegrasses. After continued overgrazing, these grasses decrease in extent and Kentucky bluegrass, sedges, and forbs increase. To ensure plant vigor, grazing should be delayed until the soil has warmed sufficiently in the spring and the forage species have achieved adequate growth. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Loamy Terrace range site. The potential native vegetation on this site is mixed prairie grasses. Western wheatgrass, green needlegrass, and needleandthread, the major cool-season grasses, make up about 70 percent of the vegetation. Warm-season grasses, such as big bluestem, blue grama, prairie sandreed, sideoats grama, little bluestem, and sedges, make up about 15 percent. The remaining vegetation consists of heath aster, yarrow, scurfpea, sagewort, rose, western snowberry, leadplant, buffaloberry, and chokecherry. Cottonwood and green ash grow along some streams and abandoned oxbows.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing, the extent of bluestem and green needlegrass decreases and the extent of prairie sandreed, western wheatgrass, needleandthread, and sideoats grama increases. If overgrazing continues, these grasses thin out and are replaced by blue grama and Kentucky bluegrass. The result is low forage production. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Mountain Prairie range site. The potential native vegetation on this site is mixed prairie grasses. Warm-season grasses make up about 60 percent of the vegetation. The major warm-season species are little bluestem, sideoats grama, big bluestem, and prairie dropseed. Cool-season grasses, such as western wheatgrass, needleandthread, and junegrass, make up about 25 percent. Other plants, such as sedges, forbs, and leadplant, make up the remainder.

The major management concern on this site is maintaining the extent of little bluestem, big bluestem, and leadplant. After continued overgrazing, these species decrease in extent and Kentucky bluegrass, blue grama, sedges, and forbs increase. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred

grazing program that provides periodic rest periods during the key growing seasons of these plants.

Overflow range site. The potential native vegetation on this site is mixed prairie grasses. Big bluestem, a tall warm-season grass, makes up about 25 percent of the vegetation. Other warm-season grasses, such as switchgrass, indiangrass, and little bluestem, make up about 20 percent. Cool-season grasses, such as green needlegrass and western wheatgrass, make up about 35 percent. Part of the remaining vegetation consists of forbs, leadplant, snowberry, wild rose, and sedges. Ponderosa pine, green ash, cottonwood, ironwood, bur oak, quaking aspen, and paper birch grow in some areas.

The major management concern on this site is maintaining the extent of the most productive grasses. After continuous overgrazing, big bluestem, switchgrass, green needlegrass, indiangrass, and little bluestem rapidly thin out and the extent of western wheatgrass and Kentucky bluegrass increases. If overgrazing continues, Kentucky bluegrass, a short, cool-season grass, increases in extent and becomes dominant. The result is low forage production. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Saline Lowland range site. The potential native vegetation on this site is salt-tolerant grasses. Western wheatgrass and alkali sacaton make up about 75 percent of the vegetation. Prairie cordgrass, inland saltgrass, blue grama, and Nuttall alkaligrass make up about 20 percent. Sedges and forbs make up the remainder. In some areas where the soil has a seasonal high water table, prairie cordgrass makes up as much as 60 percent of the vegetation.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing, western wheatgrass, prairie cordgrass, and alkali sacaton decrease in extent and inland saltgrass becomes the principal grass on the site. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Sandy range site. The potential native vegetation on this site is mixed prairie grasses, chiefly mid and tall grasses. Warm-season grasses, such as big bluestem, sand bluestem, little bluestem, and prairie sandreed, make up about 65 percent of the vegetation. Cool-season grasses, such as needleandthread and western wheatgrass, make up about 20 percent. Blue grama and sedges make up about 10 percent. Forbs, such as scurfpea and sagewort, make up the remainder. Bur oak, cottonwood, and green ash grow along some stream channels.

The major management concern on this site is maintaining the extent of the most productive grasses. After continuous overgrazing, bluestems decrease in extent and prairie sandreed and needleandthread increase. If overgrazing continues, these grasses thin out and are replaced by sand dropseed, blue grama, threadleaf sedge, sagewort, and Kentucky bluegrass. The result is low forage production. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Savannah range site. The potential native vegetation on this site is a sparse overstory of ponderosa pine and an understory of mixed prairie grasses. Warm-season grasses, such as little bluestem, sideoats grama, big bluestem, and hairy or blue grama, make up about 75 percent of the understory vegetation. Forbs, sedges, and leadplant make up the remainder.

The major management concern on this site is maintaining the extent of little bluestem, big bluestem, and leadplant. After continued overgrazing, these species decrease in extent and sedges, yucca, and pricklypear cactus increase. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Shallow range site. The potential native vegetation on this site is mixed prairie grasses. Warm-season grasses, such as little bluestem, sideoats grama, and big bluestem, make up about 60 percent of the vegetation. Cool-season grasses, such as western wheatgrass and needleandthread, make up about 15 percent. Sedges, forbs, and shrubs make up the remainder.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing little bluestem and big bluestem decrease in extent and needleandthread and sideoats grama increase. If overgrazing continues,

sideoats grama and needleandthread are replaced by a sparse cover of sedges, blue grama, and weeds. The result is low forage production. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Shallow Clay range site. The potential native vegetation on this site is mixed prairie grasses. Western wheatgrass and green needlegrass make up about 40 percent of the vegetation. Warm-season grasses, such as little bluestem, sideoats grama, and blue grama, make up about 40 percent. Forbs, such as scurfpea, sagewort, blacksamson, and sedges, make up about 10 percent. Shrubs, particularly big sagebrush, make up the remainder. Some areas have a sparse overstory of ponderosa pine.

The major management concern on this site is maintaining the extent of the most productive grasses. If the range is overgrazed, green needlegrass, western wheatgrass, and sideoats grama decrease in extent and blue grama and unpalatable forbs increase. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Silty range site. Cool-season grasses make up about 65 percent of the potential vegetation on this site. Green needlegrass and western wheatgrass are the dominant cool-season grasses. Others include needleandthread and porcupinegrass. Warm-season grasses, such as little and big bluestem, sideoats grama, and blue grama, make up about 25 percent of the vegetation. Shrubs and forbs, such as sagewort, heath aster, yarrow, false-boneset, leadplant, rose, goldenrod, and western snowberry, make up the remainder.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued grazing, bluestems, western wheatgrass, green needlegrass, porcupinegrass, and needleandthread are replaced by blue grama, Kentucky bluegrass, and threadleaf sedge. The result is low forage production. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Stony Hills range site. The potential native vegetation on this site is a mixture of mid and tall, warm-season grasses. Big bluestem and little bluestem make up about 55 percent of the vegetation. Sideoats grama and prairie dropseed are less extensive. Cool-season grasses, such as green needlegrass, western wheatgrass, and sedges, grow in most areas. They make up about 25 percent of the vegetation. Bluegrasses, blue grama, and junegrass are included in the understory. Forbs and shrubs make up the remainder of the vegetation. Typical forbs are sagewort, scurfpea, dotted gayfeather, and prairie-clover. Shrubs, such as leadplant, wild rose, and western snowberry, are less extensive than forbs.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing, big bluestem and little bluestem decrease in extent and western wheatgrass, blue grama, and bluegrasses increase. The result is low forage production. If overgrazing continues, western wheatgrass decreases in extent and sedges and undesirable forbs and weedy grasses increase. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Subirrigated range site. The potential native vegetation on this site is a stand of tall grasses. Northern or bluejoint reedgrass and prairie cordgrass have the potential to dominate the site. They can produce more forage than any other species. Big bluestem, a warm-season grass, makes up less than 10 percent of the vegetation. Bluegrasses and needlegrasses make up about 10 percent, and sedges and forbs make up about 10 percent. The remaining vegetation consists of Black Hills spruce, willows, quaking aspen, and paper birch.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing, reedgrasses, prairie cordgrass, and big bluestem thin out and the low-growing bluegrasses and sedges dominate the site. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Thin Claypan range site. The potential native vegetation on this site is a mixture of mid and short grasses. Short, warm-season grasses dominate the site. Blue grama makes up about 40 percent of the

vegetation, and buffalograss makes up about 15 percent. Needleandthread and mid, cool-season grasses, such as western wheatgrass, make up about 30 percent. Pricklypear, sagebrush, and forbs, such as sagewort and broom snakeweed, make up the remainder.

The major management concern on this site is maintaining the extent of western wheatgrass and needleandthread. After continued overgrazing, these grasses thin out and are replaced by blue grama, buffalograss, pricklypear, and inland saltgrass. If overgrazing continues, much of the surface is bare, especially during dry periods. Weeds increase in extent during wet periods. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants. Restricted grazing during wet periods helps to prevent surface compaction and the deterioration of tilth.

Thin Upland range site. The potential native vegetation on this site is mixed prairie grasses. Warm-season grasses, such as little bluestem and sideoats grama, make up about 50 percent of the vegetation. Cool-season grasses, such as western wheatgrass, green needlegrass, and needleandthread, make up about 30 percent. Threadleaf sedge and blue grama, the major understory plants, make up about 15 percent. Woody plants and forbs, such as sagewort, make up the remainder.

The major management concern on this site is maintaining the extent of the most productive grasses. After continued overgrazing, little bluestem, sideoats grama, green needlegrass, and western wheatgrass decrease in extent. If overgrazing continues, sedges and blue grama dominate the site. The result is low forage production. The extent of the most productive grasses can be maintained by proper stocking rates and a rotation grazing or deferred grazing program that provides periodic rest periods during the key growing seasons of these plants.

Woodland Management and Productivity

Sheridan Dronen, forester, Soil Conservation Service, prepared this section.

Ponderosa pine is the main tree species of commercial value in the Black Hills. Other tree species common to the area are American elm, Black Hills spruce, bur oak, eastern hophornbeam, paper birch, quaking aspen, and Rocky Mountain juniper. Of the soils in the survey area, Stovho and Lail soils have the highest potential for timber production. Virkula, Citadel, and Buska soils have the next highest potential, and Paunsaugunt and Hopdraw soils have the lowest potential.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each suitable soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils in terms of cubic meters of wood per hectare per year for an indicator tree species. It is based on the site index of the species listed first in the *common trees* column. A mean annual increment of 1 cubic meter per hectare equals 14.3 cubic feet per acre. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excessive water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, high content of coarse fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 7, *slight*, *moderate*, and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of soil loss in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive soil loss.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A

rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *windthrow hazard* are based on soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that no trees are normally blown down by strong winds; *moderate*, that an occasional tree will be blown down during periods of excessive soil wetness and strong winds; and *severe*, that many trees are blown down during these periods.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; and *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Volume is the number of cubic feet of wood produced per acre per year for the indicator tree species. This number indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand. Ponderosa pine is the indicator species for all map units.

The interpretations in table 7 are based on plot and field data collected by the Soil Conservation Service and the Forest Service. The site index curves used were developed by E.M. Hornibrook for the Black Hills of South Dakota and Wyoming. The reference age is 100 years.

Woodland Understory Vegetation

Understory vegetation consists of grasses, sedges, forbs, shrubs, and other plants. Most of the woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive. Forage production for livestock and big game animals increases after the timber canopy is opened by fire or timber management.

Soils that produce approximately the same kinds, amounts, and proportions of understory vegetation make up a grazable woodland group. The relationship between the soils and the vegetation and canopy cover was ascertained during this survey *(4)*. Thus, grazable woodland groups generally can be determined directly from the soil map. In this survey area, the wooded soils were grouped into six grazable woodland groups. The soil and environmental properties considered in the groupings were soil texture, rock fragments, precipitation, elevation, depth to bedrock, and slope aspect.

The six grazable woodland groups are briefly described in the following paragraphs.

High Woodland.—This grazable woodland group consists of deep and moderately deep, well drained soils formed in material weathered from sedimentary rock. All of these soils are on the higher parts of the Limestone Plateau, at elevations of 6,200 feet or more. This group includes the Lail, Stovho, and Trebor soils.

Silty Foot Slopes.—This grazable woodland group consists of deep, well drained soils formed in material weathered from sedimentary or metamorphic rock. These soils have less than 35 percent rock fragments in the root zone. They are in coves and swales at elevations ranging from 3,400 to 6,200 feet. This group includes the Citadel, Lakoa, and Virkula soils.

Rocky Side Slopes.—This grazable woodland group consists of deep, well drained soils formed in material weathered from sedimentary, metamorphic, or igneous rock. These soils have more than 35 percent rock fragments in the root zone. They are on mountain side slopes, ridges, and peaks at elevations ranging from 4,000 to 6,200 feet. This group includes the Buska, Mocmont, and Pactola soils and the forested Hilger soils.

Shallow Ridge.—This grazable woodland group consists of shallow, well drained and excessively drained soils formed in material weathered from sandstone and limestone. These soils are on ridges and mountain side slopes at elevations ranging from 3,200 to 6,200 feet. Bedrock is at a depth of 10 to 20 inches. This group includes the forested Butche and Paunsaugunt soils.

Cool Slopes.—This grazable woodland group consists of deep, well drained soils formed in material weathered from limestone and sandstone. These soils have more than 35 percent rock fragments in the root zone. They are on narrow ridgetops and mountain side slopes that generally have a north aspect. Elevations range from 3,200 to 6,000 feet. This group includes the Rockoa and Vanocker soils.

Warm Slopes.—This grazable woodland group consists of deep, well drained soils formed in material weathered from limestone and sandstone. These soils have more than 35 percent rock fragments in the root zone. They are on mountain side slopes that generally have a south aspect. Elevations range from 3,400 to 6,200 feet. This group includes the Hopdraw and Sawdust soils.

Table 8 shows, for each soil that is suitable for woodland and has a slope of less than 40 percent, the potential for producing understory vegetation. The total production of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4½ feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimum part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

Table 8 also lists the common names of the characteristic vegetation on each soil and the percentage composition, by air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under given canopy densities.

Windbreaks and Environmental Plantings

Windbreaks are not grown extensively in the Black Hills because native trees and shrubs are common. Environmental plantings are used to help beautify and screen houses and other buildings and to abate noise. The selection of hardy nursery stock, planted properly and maintained in good condition, can ensure a high degree of plant survival.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens.

At the end of many descriptions under the heading "Detailed Soil Map Units," the soil has been assigned to a windbreak suitability group. These groups are based primarily on the suitability of the soil for locally adapted species, as is indicated by their growth and vigor. Detailed interpretations for each windbreak suitability group in the survey area are provided in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for hard-surfaced roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to

heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling (fig. 9). The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Connie M. Vicuna, biologist, Soil Conservation Service, prepared this section.

Wildlife and fishery resources are abundant in this survey area. The primary wildlife habitats are forest land and rangeland interspersed with small areas of cropland, pasture and hayland, and some wetland. Forestry, mining, tourism, and grazing are the major land uses in this survey area, which is primarily national forest and other public land. All of these activities significantly affect the availability and quality of wildlife habitat. Multipurpose management plans developed for the national forest have the most significant influence on the habitat.

The wildlife species in the survey area include white-tailed deer, mule deer, turkeys, ruffed grouse, elk, red squirrels, flying squirrels, and numerous woodland and grassland birds. Antelope, prairie dogs, and sharp-tailed grouse are common in the areas of rangeland. The common predators include raccoons, skunks, coyotes, red and gray fox, bobcats, golden eagles, and red-tailed hawks.

Fish are abundant in the streams and reservoirs of the Black Hills. Trout are regularly stocked in many streams and lakes for public fishing. The areas of wetland habitat are primarily along or near streams and reservoirs. These areas are inhabited by some waterfowl species, beaver, muskrats, and mink.

The survey area is suited primarily to native forest land and rangeland habitats, which vary somewhat in different topographic regions. Soil associations represent distinct topographical or geological units that have unique sets of soil capability and management factors. These associations therefore provide some indication of the actual and potential distribution and density of wildlife and their habitat. The associations in the survey area are described under the heading "General Soil Map Units."

White-tailed deer and mule deer are throughout the survey area. White-tailed deer are abundant throughout the entire area, and mule deer are most abundant in the Canyon-Rockoa-Rock outcrop, Nevee-Gypnevee-Rekop, Vanocker-Sawdust-Paunsaugunt, and Grummit-Arvada associations. During the summer deer concentrate in areas that provide abundant undergrowth, especially forbs. In the winter they concentrate at the lower elevations, in areas with high vegetative diversity, good browse conditions, and little snow cover. These conditions are characteristic of the Vanocker-Sawdust-Paunsaugunt association.

Turkeys are in all parts of the survey area, except for the Grummit-Arvada association. The highest populations are in areas of the Pactola-Rock outcrop-Virkula and Buska-Mocmont-Rock outcrop associations. Elk are in nearly all parts of the survey area but are abundant only in and near Custer State Park. Areas essential to elk are those that provide a good combination of rangeland and woody habitats.

Red squirrels and northern flying squirrels inhabit woody habitats in all of the associations. Only the Grummit-Arvada association does not have a significant squirrel population. Antelope and sharp-tailed grouse are in areas of the associations that are predominantly rangeland or have a high percentage of rangeland habitat. Both species are in areas of the Nevee-Gypnevee-Rekop and Grummit-Arvada associations. Also, antelope inhabit areas of the Vanocker-Sawdust-Paunsaugunt association, and sharp-tailed grouse inhabit areas of the Heely-Cordeston association.

Sage grouse inhabit only the Grummit-Arvada association, in the extreme southwestern part of the survey area. This association consists of open range with areas of sagebrush and similar brushy habitat.

Soils affect the kind and amount of vegetation that is

Figure 9.—An area of Rock outcrop-Mocmont complex, 40 to 80 percent slopes. This is a popular hiking area.

available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing specific elements of wildlife habitat. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining the habitat elements; and in determining the intensity of managment needed for each habitat element.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the

element can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element. The element can be established, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element are very severe and that unsatisfactory results can be expected. Establishing, improving, or maintaining the element is impractical or impossible.

The elements of wi dlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture also are considerations. Examples of grain and seed crops are corn, sorghum, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are intermediate wheatgrass, pubescent wheatgrass, and alfalfa.

Native herbaceous plants are naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture also are considerations. Examples of these plants are bluestem, goldenrod, beggarweed, western wheatgrass, and grama.

Native deciduous trees and woody understory produce nuts or other fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwoods and shrubs are depth of the root zone, available water capacity, and wetness. Examples are oak, aspen, hophornbeam, cottonwood, ash, willow, plum, and chokecherry.

Native coniferous trees furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous trees are pine, spruce, cedar, and juniper.

Native shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are skunkbush sumac, mountainmahogany, bearberry, snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features that affect wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features that affect shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

Planted trees and shrubs include species that require cultivation before and during establishment. They eventually provide fruit, buds, twigs, bark, and foliage. Soil properties that affect the growth of trees and shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of these plants are green ash, Russian-olive, plum, chokecherry, Rocky Mountain juniper, and eastern redcedar.

Information concerning the elements needed to maintain and manage the habitat for specific wildlife species can be obtained from the local office of the Soil Conservation Service or from the South Dakota Department of Game, Fish and Parks.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use

planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, the shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and hard-surfaced roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and the shrink-swell potential can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Hard-surfaced roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are

generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. The depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), the shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Sanitary Facilities

Table 13 shows the degree and kind of soil imitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, and large stones.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of

the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and the shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such

properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

Table 15 also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability in the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders or of salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across

a slope to help control water erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

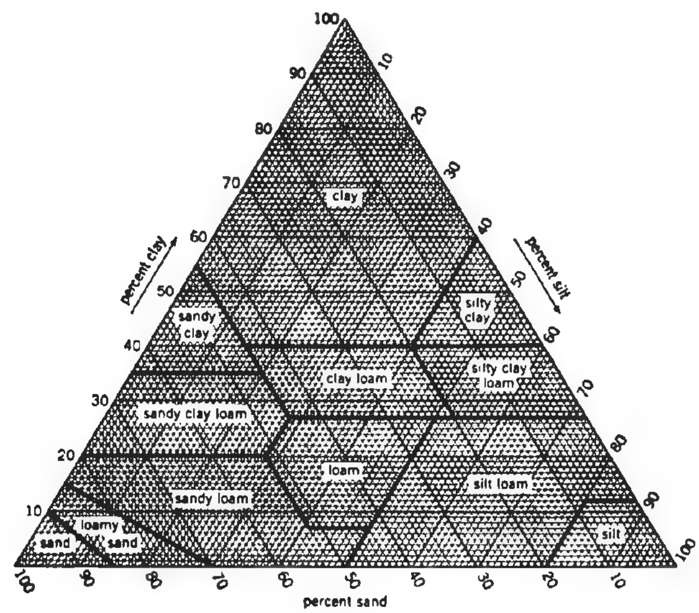


Figure 10.—Percentages of sand, silt, and clay in the basic USDA soil textural classes.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 10). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and

highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated content of clay in each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. The available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. The available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and s expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; *high*, 6 to 9 percent; and *very high*, greater than 9 percent.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a

percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from the adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table, the kind of water table, and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18. Only saturated zones within a depth of about 6 feet are indicated. An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in

evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(11)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Cumulic* identifies the subgroup that has a thicker surface layer than is definitive of the great group. An example is Cumulic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, frigid Cumulic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (9)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (11)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Arvada Series

The Arvada series consists of deep, well drained, sodium affected soils formed in clayey and loamy alluvium and colluvium. These soils are on uplands and terraces. Permeability is very slow. Slopes range from 0 to 6 percent.

Typical pedon of Arvada fine sandy loam, in an area of Arvada-Slickspots complex, 0 to 3 percent slopes, 1,200 feet west and 960 feet south of the northeast corner of sec. 7, T. 6 S., R. 1 E.

E—0 to 3 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak thick platy structure parting to weak fine granular; soft, very friable; neutral; abrupt smooth boundary.

Bt1—3 to 6 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium and coarse columnar structure parting to moderate medium blocky; hard, very firm; shiny films on faces of peds; moderately alkaline; clear wavy boundary.

Bt2—6 to 12 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, very firm; patchy films on faces of peds; slight effervescence; moderately alkaline; gradual wavy boundary.

Bkz—12 to 20 inches; pale brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; hard, firm; common medium nests of salts; common medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—20 to 60 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; massive; hard, very firm; few fine nests of salts; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to carbonates ranges from 0 to 12 inches. Salts are below a depth of 8 inches. Some pedons have a thin A horizon.

The E horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 or 3. It dominantly is fine sandy loam but is loam in some pedons. The Bt horizon has hue of 7.5YR or 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 3 or 4. It is clay or clay loam. The content of clay in this horizon is as low as 35 percent in some pedons and as high as 45 percent in others. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is clay or clay loam.

Arvada Variant

The Arvada Variant consists of deep, poorly drained, sodium affected soils formed in clayey and loamy alluvium. These soils are on low terraces. Permeability is very slow. Slopes range from 0 to 2 percent.

Typical pedon of Arvada Variant loam, 0 to 2 percent slopes, 2,200 feet east and 2,300 feet north of the southwest corner of sec. 18, T. 6 S., R. 1 E.

E—0 to 2 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak thin platy; slightly hard, friable; mildly alkaline; abrupt smooth boundary.

Bt—2 to 4 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium columnar structure parting to strong medium blocky; very hard, very firm; shiny films on faces of peds; mildly alkaline; clear smooth boundary.

Btz—4 to 10 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very firm; patchy films on faces of peds; common fine nests of salts; moderately alkaline; clear smooth boundary.

Bz—10 to 18 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; hard, firm; common fine nests of salts; moderately alkaline; clear wavy boundary.

C1—18 to 36 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common medium distinct brownish yellow (10YR 6/6 moist) mottles; massive; hard, firm; few or common medium nests of salts; slight effervescence; moderately alkaline; clear wavy boundary.

C2—36 to 50 inches; light olive brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; common fine distinct brownish yellow (10YR 6/6 moist) mottles; massive; hard, firm; few or common fine nests of salts; slight effervescence; moderately alkaline; clear wavy boundary.

C3—50 to 60 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; common medium distinct brownish yellow (10YR 6/6 moist) mottles; massive; hard, firm; few fine nests of salts; strong effervescence; moderately alkaline.

The depth to carbonates ranges from 10 to 20 inches. Salts are below a depth of 4 inches. Some pedons have a thin A horizon.

The E horizon has value of 6 or 7 (4 or 5 moist) and chroma of 1 or 2. It is dominantly loam but is silt loam in some pedons. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 or 2. It is clay, clay loam, or silty clay loam. The content of clay in this horizon is as low as 35 percent in some pedons and as high as 45 percent in others. The C horizon has hue of 10YR or 2.5Y and value of 5 to 7 (4 to 6 moist). It is clay, silty clay loam, clay loam, or loam.

Barnum Series

The Barnum series consists of deep, well drained soils that formed in calcareous, loamy alluvium weathered from reddish siltstone, sandstone, and silty shale. These soils are on flood plains and terraces. Permeability is moderate. Slopes range from 0 to 3 percent.

Typical pedon of Barnum very fine sandy loam, 0 to 3 percent slopes, 175 feet south and 300 feet west of the northeast corner of sec. 11, T. 6 S., R. 1 E.

A1—0 to 2 inches; yellowish red (5YR 5/6) very fine sandy loam, reddish brown (5YR 4/4) moist; very weak medium granular structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

A2—2 to 5 inches; reddish yellow (5YR 6/6) loam, yellowish red (5YR 4/6) moist; weak fine and medium subangular blocky structure; soft, very friable; strong effervescence; mildly alkaline; clear smooth boundary.

C—5 to 32 inches; reddish yellow (5YR 6/6) loam that has very thin strata of very fine sandy loam; yellowish red (5YR 5/6 and 4/6) moist; massive; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

Ab—32 to 44 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 3/4) moist; massive; soft, very friable; strong effervescence; mildly alkaline; gradual wavy boundary.

C'1—44 to 50 inches; yellowish red (5YR 5/6) loam, reddish brown (5YR 4/4) moist; massive; soft, very friable; strong effervescence; moderately alkaline; gradual wavy boundary.

C'2—50 to 60 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The control section typically is loam but is silt loam or clay loam in some pedons. The content of clay is as low as 18 percent in some pedons and as high as 35 percent in others. Some pedons do not have a buried surface layer. Pebbles less than 2 inches in diameter make up 0 to 10 percent of the soil volume.

The A horizon has hue of 7.5YR to 2.5YR, value of 3 to 5 moist, and chroma of 2 to 6. The C horizon has hue of 5YR or 2.5YR and value of 5 or 6.

Bridget Series

The Bridget series consists of deep, well drained soils formed in loamy material weathered from sedimentary rocks. These soils are on uplands. Permeability is moderate. Slopes range from 9 to 25 percent.

Typical pedon of Bridget very fine sandy loam, in an area of Canyon-Bridget complex, 9 to 25 percent slopes, 2,080 feet west and 600 feet south of the northeast corner of sec. 22, T. 2 N., R. 7 E.

A1—0 to 4 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

A2—4 to 9 inches; brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) moist; moderate medium and coarse subangular blocky structure; soft, friable; strong effervescence; mildly alkaline; clear smooth boundary.

AC—9 to 17 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; gradual smooth boundary.

C1—17 to 32 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; violent effervescence; mildly alkaline; gradual smooth boundary.

C2—32 to 60 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable; violent effervescence; mildly alkaline.

The depth to carbonates ranges from 0 to 6 inches. The mollic epipedon is 7 to 14 inches thick.

The A horizon has value of 4 or 5 (2 or 3 moist). It is dominantly very fine sandy loam but is loam or silt loam in some pedons. The C horizon has value of 4 to 6 when moist and has chroma of 2 to 4. It is dominantly

very fine sandy loam or silt loam, but it has thin strata of fine sandy loam or loam in some pedons.

Bullflat Series

The Bullflat series consists of deep, well drained soils formed in silty alluvial or colluvial sediments weathered from sedimentary rock. These soils are on mountain prairies. Permeability is moderate. Slopes range from 0 to 9 percent.

Typical pedon of Bullflat silt loam, 0 to 3 percent slopes, 2,500 feet north and 800 feet east of the southwest corner of sec. 21, T. 1 S., R. 7 E.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable; about 5 percent rock fragments by volume; neutral; clear smooth boundary.

Bt1—6 to 10 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to moderate medium granular; hard, friable; shiny films on faces of peds; about 5 percent rock fragments by volume; neutral; clear smooth boundary.

Bt2—10 to 18 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, friable; patchy films on faces of peds; about 5 percent rock fragments by volume; neutral; clear smooth boundary.

Bt3—18 to 21 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; very hard, friable; patchy films on faces of peds; about 5 percent rock fragments by volume; neutral; abrupt wavy boundary.

Bk—21 to 28 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; hard, friable; about 10 percent rock fragments by volume; many coarse and fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

2C1—28 to 32 inches; very pale brown (10YR 7/4) gravelly clay loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable; about 30 percent rock fragments by volume; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

2C2—32 to 60 inches; very pale brown (10YR 8/4) very cobbly clay loam, very pale brown (10YR 7/4) moist; massive; slightly hard, friable; accumulations of carbonate on undersides of pebbles; about 40 percent rock fragments by volume; strong effervescence; moderately alkaline.

The depth to carbonates typically is 12 to 22 inches but ranges from 10 to 34 inches. Coarse fragments range in size from gravel to flagstones and make up 0 to 10 percent of the A and Bt horizons and 15 to 50 percent of the 2C horizon by volume. Some pedons have common or many fine particles of mica.

The A horizon has hue of 5YR, 7.5YR, or 10YR, value of 3 or 4 (2 or 3 moist), and chroma of 1 or 2. It is silt loam or loam. The Bt horizon has hue of 5YR, 7.5YR, or 10YR and value of 4 to 6. It is silt loam, silty clay loam, or clay loam. The content of clay in this horizon is as low as 20 percent in some pedons and as high as 34 percent in others. Some pedons have a C horizon. The 2C horizon has hue of 2.5YR to 10YR, value of 6 to 8 (4 to 7 moist), and chroma of 3 to 6. It is gravelly clay loam, very cobbly clay loam, gravelly loam, or gravelly silt loam.

Buska Series

The Buska series consists of deep, well drained soils formed in loamy material weathered from micaceous schist. These soils are on mountain side slopes and ridges. Permeability is moderate. Slopes range from 2 to 50 percent.

Typical pedon of Buska loam, in an area of Buska-Rock outcrop complex, 10 to 40 percent slopes, 800 feet south and 400 feet east of the northwest corner of sec. 8, T. 2 S., R. 4 E.

Oi—1 inch to 0; forest litter.

A—0 to 1 inch; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; about 5 percent rock fragments by volume; neutral; abrupt smooth boundary.

E—1 to 12 inches; pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; weak medium platy structure parting to weak fine granular; soft, very friable; about 5 percent rock fragments by volume; neutral; clear wavy boundary.

E/B—12 to 15 inches; brown (10YR 5/3) channery loam, dark brown (10YR 4/3) moist (E); yellowish brown (10YR 5/4) channery loam, dark yellowish brown (10YR 4/4) moist (B); weak medium subangular blocky structure; soft, very friable; about

20 percent rock fragments by volume; slightly acid; clear wavy boundary.

Bt—15 to 25 inches; yellowish brown (10YR 5/4) very channery loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; shiny films on faces of peds; about 40 percent rock fragments by volume; medium acid; gradual wavy boundary.

C—25 to 41 inches; light yellowish brown (10YR 6/4) very channery loam, yellowish brown (10YR 5/4) moist; massive; soft, friable; about 45 percent rock fragments by volume; slightly acid; gradual wavy boundary.

Cr—41 to 60 inches; yellowish brown (10YR 5/4), micaceous schist.

The depth to micaceous schist ranges from 40 to 60 inches. Rock fragments range in size from channers to flagstones and make up 35 to 75 percent of the Bt horizon by volume.

Some pedons do not have an A horizon. The E horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3. It is silt loam or loam. The Bt horizon has hue of 7.5YR or 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is very channery silt loam or very channery loam. The content of clay in this horizon is as low as 18 percent in some pedons and as high as 25 percent in others.

Butche Series

The Butche series consists of shallow, excessively drained soils formed in material weathered from sandstone. These soils are on mountain ridges and side slopes. Permeability is moderate. Slopes range from 2 to 60 percent.

Typical pedon of Butche cobbly loam, in an area of Butche-Rock outcrop complex, 9 to 60 percent slopes, 1,000 feet west and 835 feet north of the southeast corner of sec. 23, T. 5 S., R. 6 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine roots; about 20 percent sandstone fragments by volume; neutral; clear wavy boundary.

C—4 to 10 inches; pale brown (10YR 6/3) cobbly loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; fine common roots; about 30 percent sandstone fragments by volume; neutral; abrupt wavy boundary.

R—10 to 60 inches; very pale brown (10YR 7/4), hard sandstone; neutral.

The depth to hard sandstone ranges from 7 to 20 inches. Rock fragments range in size from channers to boulders and make up 15 to 35 percent of the volume.

Some pedons have an O horizon. The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is cobbly loam, cobbly fine sandy loam, or loam. The C horizon has hue of 5YR to 10YR, value of 6 or 7 (4 to 6 moist), and chroma of 2 to 6. It is cobbly loam, cobbly sandy loam, or cobbly fine sandy loam.

Canyon Series

The Canyon series consists of shallow, well drained soils formed in loamy, calcareous material weathered from interbedded sandstone and limestone. These soils are on uplands. Permeability is moderate. Slopes range from 2 to 60 percent.

Typical pedon of Canyon loam, in an area of Canyon-Rock outcrop complex, 15 to 60 percent slopes, 2,000 feet east and 1,100 feet south of the northwest corner of sec. 2, T. 1 N., R. 7 E.

A—0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; soft, friable; about 5 percent rock fragments by volume; slight effervescence; mildly alkaline; clear smooth boundary.

AC—4 to 10 inches; very pale brown (10YR 7/3) gravelly loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; soft, friable; about 15 percent rock fragments by volume; slight effervescence; mildly alkaline; gradual wavy boundary.

C—10 to 18 inches; very pale brown (10YR 7/4) gravelly loam, light yellowish brown (10YR 6/4) moist; massive; soft, friable; about 20 percent rock fragments by volume; strong effervescence; mildly alkaline; clear wavy boundary.

Cr—18 to 60 inches; light gray (10YR 7/2), calcareous, soft, interbedded fine grained sandstone and fractured limestone.

The depth to bedrock ranges from 8 to 20 inches. The depth to carbonates ranges from 0 to 6 inches. Rock fragments range in size from gravel to flagstones and make up 5 to 25 percent of the volume.

The A horizon has value of 4 to 7 (3 to 5 moist) and chroma of 2 or 3. It is loam, silt loam, fine sandy loam, or very fine sandy loam. The AC and C horizons have

value of 6 to 8 (4 to 6 moist) and chroma of 2 to 4. They are gravelly loam, gravelly silt loam, or gravelly very fine sandy loam.

Citadel Series

The Citadel series consists of deep, well drained soils formed in material weathered from limestone and calcareous sandstone. These soils are on forested mountains. Permeability is slow. Slopes range from 2 to 40 percent.

Typical pedon of Citadel loam, in an area of Vanocker-Citadel complex, 10 to 40 percent slopes, 1,300 feet east and 100 feet north of the southwest corner of sec. 12, T. 2 N., R. 5 E.

Oi—1 inch to 0; forest litter.

A—0 to 1 inch; dark brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; soft, very friable; about 5 percent sandstone fragments by volume; neutral; abrupt smooth boundary.

E—1 to 10 inches; light reddish brown (5YR 6/3) loam, reddish brown (5YR 4/3) moist; very weak thin platy structure; soft, very friable; about 5 percent sandstone fragments by volume; neutral; clear smooth boundary.

B/E—10 to 14 inches; light reddish brown (5YR 6/4) clay loam, reddish brown (5YR 4/4) moist (B); reddish brown (5YR 5/3) loam, reddish brown (5YR 4/3) moist (E); weak medium prismatic structure parting to fine and medium subangular blocky; slightly hard, firm; about 5 percent sandstone fragments by volume; neutral; clear smooth boundary.

Bt1—14 to 28 inches; light reddish brown (5YR 6/4) clay, reddish brown (5YR 4/4) moist; weak medium prismatic structure parting to strong medium blocky; hard, firm; shiny films on faces of peds; about 10 percent sandstone fragments by volume; neutral; clear smooth boundary.

Bt2—28 to 34 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm; patchy films on faces of peds; about 10 percent sandstone fragments by volume; neutral; clear smooth boundary.

Bk—34 to 42 inches; yellowish brown (10YR 5/4) gravelly clay loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable; about 15 percent sandstone fragments by volume; common fine accumulations of carbonate; violent effervescence; mildly alkaline; clear smooth boundary.

C—42 to 60 inches; light yellowish brown (10YR 6/4) gravelly clay loam, dark yellowish brown (10YR 4/4) moist; massive; soft, friable; about 20 percent sandstone fragments by volume; few fine accumulations of carbonate; violent effervescence; moderately alkaline.

The depth to carbonates ranges from 14 to 36 inches. Rock fragments range in size from gravel to channers and make up 5 to 25 percent of the B horizon and 15 to 50 percent of the C horizon by volume. Bedrock is at a depth of 40 to 60 inches in some pedons.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is loam, silt loam, or very fine sandy loam. Some pedons do not have an A horizon. The E horizon has hue of 10YR to 5YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It is dominantly loam but is silt loam or very fine sandy loam in some pedons. The Bt horizon has hue of 7.5YR to 2.5YR, value of 4 to 6 (4 or 5 moist), and chroma of 3 to 6. It is clay loam, silty clay loam, silty clay, or clay. The content of clay in this horizon is as low as 35 percent in some pedons and as high as 45 percent in others. The C horizon has hue of 10YR to 5YR. It is gravelly clay loam, gravelly silt loam, or gravelly loam.

Colombo Series

The Colombo series consists of deep, well drained soils formed in calcareous, loamy alluvium. These soils are on flood plains. Permeability is moderate. Slopes range from 0 to 4 percent.

Typical pedon of Colombo loam, in an area of Colombo-Urban land complex, 0 to 2 percent slopes, 1,000 feet north and 1,200 feet east of the southwest corner of sec. 3, T. 1 N., R. 7 E.

A1—0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; very weak fine granular structure; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A2—4 to 10 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; hard, friable; about 5 percent rock fragments by volume; strong effervescence; mildly alkaline; clear smooth boundary.

C1—10 to 42 inches; brown (7.5YR 5/4) loam, dark

brown (7.5YR 4/4) moist; massive; hard, friable; about 10 percent rock fragments by volume; strong effervescence; mildly alkaline; abrupt wavy boundary.

C2—42 to 48 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable; strong effervescence; mildly alkaline; abrupt wavy boundary.

C3—48 to 60 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; massive; hard, friable; about 15 percent rock fragments by volume; slight effervescence; mildly alkaline.

The mollic epipedon is 10 to 16 inches thick. The control section is loam or clay loam. Thin layers of sand or clay loam are common. Rock fragments make up 0 to 15 percent of the volume. The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3.

Cordeston Series

The Cordeston series consists of deep, well drained soils formed in loamy alluvium weathered from sedimentary and metamorphic rock. These soils are in mountain meadows. Permeability is moderate. Slopes range from 0 to 10 percent.

Typical pedon of Cordeston loam, 2 to 10 percent slopes, 2,600 feet west and 400 feet south of the northeast corner of sec. 9, T. 1 S., R. 6 E.

A—0 to 10 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, very friable; neutral; clear smooth boundary.

Bw1—10 to 20 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate fine and medium subangular blocky structure parting to weak fine and medium granular; hard, very friable; neutral; clear smooth boundary.

Bw2—20 to 30 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; neutral; gradual wavy boundary.

Bw3—30 to 45 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; neutral; clear smooth boundary.

C—45 to 60 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable; neutral.

The mollic epipedon typically is more than 40 inches thick. The depth to carbonates also is more than 40 inches. In some pedons very thin strata of contrasting textures are at a depth of more than 30 inches. Coarse fragments make up 0 to 10 percent of the volume.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4 (2 or 3 moist), and chroma of 1 or 2. It is dominantly loam but is silt loam in some pedons. The Bw horizon has hue of 10YR or 7.5YR. It is loam or silt loam. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6 (4 or 5 moist), and chroma of 2 to 4.

The Cordeston soil in the Cordeston-Winetti complex, 2 to 9 percent slopes, is a taxadjunct to the series because it is calcareous throughout. This difference, however, does not significantly alter the use or behavior of the soil.

Demar Series

The Demar series consists of deep, moderately well drained soils formed in acid, clayey alluvium. These soils are on terraces and foot slopes. Permeability is very slow. Slopes range from 0 to 4 percent.

Typical pedon of Demar clay loam, in an area of Demar-Grummit-Slickspots complex, 0 to 6 percent slopes, 2,430 feet south and 1,110 feet east of the northwest corner of sec. 33, T. 6 S., R. 1 E.

E—0 to 5 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium platy structure parting to moderate medium granular; hard, friable; strongly acid; clear wavy boundary.

Bt1—5 to 11 inches; pale brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; strong medium columnar structure parting to strong medium subangular blocky; extremely hard, very firm; shiny films on faces of peds; strongly acid; gradual wavy boundary.

Bt2—11 to 17 inches; pale brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure; extremely hard, very firm; patchy films on faces of peds; very strongly acid; gradual wavy boundary.

Bz—17 to 24 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; weak very coarse subangular blocky structure; extremely hard, very firm; many medium accumulations and threads of salts; very strongly acid; gradual wavy boundary.

Cz—24 to 35 inches; light brownish gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) moist; massive;

hard, firm; many medium accumulations and threads of salts; very strongly acid; gradual wavy boundary.

C—35 to 60 inches; pale brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; massive; hard, firm; few fine accumulations of salts in the upper part; extremely acid.

The E and Bt horizons have hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. The E horizon is loam or clay loam. The content of clay in the Bt horizon is as low as 35 percent in some pedons and as high as 60 percent in others. The C horizon has hue of 10YR or 2.5Y and value of 5 or 6 (4 or 5 moist).

Fairburn Series

The Fairburn series consists of shallow, well drained soils formed in material weathered from calcareous mudstone. These soils are on uplands. Permeability is moderately slow. Slopes range from 9 to 40 percent.

Typical pedon of Fairburn cobbly silty clay loam, in an area of Norrest-Fairburn-Metre complex, 9 to 40 percent slopes, 2,300 feet east and 2,000 feet north of the southwest corner of sec. 24, T. 4 S., R. 6 E.

A—0 to 3 inches; dark grayish brown (10YR 4/2) cobbly silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, friable; about 20 percent rock fragments by volume; mildly alkaline; clear smooth boundary.

AC—3 to 8 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist, dark grayish brown (10YR 4/2) moist and crushed; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; strong effervescence; mildly alkaline; clear wavy boundary.

C—8 to 18 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, friable; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr1—18 to 32 inches; very pale brown (10YR 8/3) mudstone, very pale brown (10YR 7/3) moist; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr2—32 to 60 inches; very pale brown (10YR 8/4) and white (10YR 8/1), interbedded loamy mudstone and gravelly mudstone; violent effervescence; moderately alkaline.

The depth to bedrock ranges from 10 to 20 inches. The depth to carbonates ranges from 0 to 4 inches.

The A horizon has hue of 10YR or 7.5YR, value of 4 to 6 (3 to 5 moist), and chroma of 1 to 3. It is cobbly silty clay loam or cobbly clay loam. Rock fragments range in size from gravel to stones and make up 15 to 30 percent of the A horizon by volume. The C horizon has hue of 2.5Y to 7.5YR, value of 6 to 8 (4 to 7 moist), and chroma of 2 to 4. It is silty clay loam or clay loam.

Glenberg Series

The Glenberg series consists of deep, well drained soils formed in calcareous, loamy alluvium. These soils are on flood plains. Permeability is moderately rapid. Slopes range from 0 to 4 percent.

Typical pedon of Glenberg fine sandy loam, 0 to 4 percent slopes, 1,700 feet east and 1,500 feet north of the southwest corner of sec. 17, T. 2 N., R. 7 E.

Ap—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—5 to 7 inches; pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 3/3) moist; single grain; loose; strong effervescence; moderately alkaline; clear smooth boundary.

C2—7 to 15 inches; dark brown (10YR 4/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; loose; about 14 percent gravel by volume; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—15 to 30 inches; brown (10YR 5/3) fine sandy loam, very dark brown (10YR 2/2) moist; massive; soft, very friable; strong effervescence; moderately alkaline; gradual wavy boundary.

C4—30 to 60 inches; dark brown (10YR 4/3) loamy fine sand, very dark grayish brown (10YR 3/2) moist; single grain; loose; strong effervescence; moderately alkaline.

The depth to carbonates is 0 to 4 inches. The content of coarse fragments ranges from 0 to 15 percent throughout the profile. The control section generally is fine sandy loam or loamy fine sand but is loam in some pedons. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 or 3.

Grummit Series

The Grummit series consists of shallow, well drained soils formed in clayey material weathered from acid

shale. These soils are in the uplands. Permeability is moderately slow. Slopes range from 2 to 60 percent.

Typical pedon of Grummit clay, in an area of Grummit-Rock outcrop complex, 15 to 60 percent slopes, 1,700 feet east and 800 feet south of the northwest corner of sec. 16, T. 6 S., R. 1 E.

A—0 to 4 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak fine and medium granular structure; hard, friable; about 10 percent soft shale fragments by volume; strongly acid; clear smooth boundary.

C1—4 to 8 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; massive; hard, friable; about 25 percent soft shale fragments by volume; strongly acid; clear wavy boundary.

C2—8 to 16 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; massive; hard, friable; about 30 percent soft shale fragments by volume; very strongly acid; gradual wavy boundary.

Cr—16 to 60 inches; dark gray (2.5Y 4/0), soft shale; very strongly acid.

The depth to shale ranges from 10 to 20 inches. The A horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. It is clay or clay loam. The content of soft shale fragments in this horizon ranges from 5 to 25 percent by volume. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 (3 or 4 moist), and chroma of 1 or 2. The content of soft shale fragments in this horizon ranges from 20 to 50 percent by volume.

Gurney Series

The Gurney series consists of moderately deep, well drained soils formed in material weathered from sedimentary rock. These soils are on mountain prairies. Permeability is moderate. Slopes range from 2 to 15 percent.

Typical pedon of Gurney loam, in an area of Paunsaugunt-Gurney complex, 2 to 15 percent slopes, 2,100 feet north and 1,300 feet east of the southwest corner of sec. 32, T. 4 S., R. 3 E.

A—0 to 5 inches; dark brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; soft, very friable; slightly acid; clear smooth boundary.

Bt1—5 to 9 inches; dark brown (7.5YR 4/4) loam, dark reddish brown (5YR 3/4) moist; moderate fine and medium subangular blocky structure; soft, very friable; shiny films on faces of peds; neutral; clear smooth boundary.

Bt2—9 to 16 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak medium prismatic structure parting to moderate medium blocky; hard, friable; patchy films on faces of peds; neutral; abrupt wavy boundary.

Bk1—16 to 22 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; very hard, friable; few fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Bk2—22 to 28 inches; light yellowish brown (10YR 6/4) channery clay loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; very hard, friable; about 20 percent rock fragments by volume; common fine accumulations of carbonate; violent effervescence; moderately alkaline; abrupt smooth boundary.

R—28 to 60 inches; red (2.5YR 5/6), indurated sandstone; strong effervescence.

The depth to carbonates typically is 12 to 18 inches but ranges from 10 to 24 inches. Rock fragments range in size from channers to flagstones and make up 0 to 20 percent of the A and Bt horizons and 0 to 35 percent of the Bk horizon by volume. The depth to consolidated bedrock ranges from 20 to 40 inches.

The A horizon has hue of 5YR to 10YR, value of 3 or 4 (2 or 3 moist), and chroma of 1 to 3. It is silt loam or loam. The Bt horizon has hue of 2.5YR to 7.5YR and value of 4 to 6 (3 or 4 moist). It is silt loam, loam, or clay loam. The content of clay in this horizon is as low as 20 percent in some pedons and as high as 35 percent in others. Some pedons have a C horizon.

Gypnevee Series

The Gypnevee series consists of deep, well drained soils formed in material weathered from reddish, gypsiferous siltstone. These soils are in the uplands. Permeability is moderate. Slopes range from 6 to 20 percent.

Typical pedon of Gypnevee silt loam, in an area of Gypnevee-Rekop-Rock outcrop complex, 6 to 15 percent slopes, 2,600 feet west and 270 feet south of the northeast corner of sec. 29, T. 2 N., R. 7 E.

A—0 to 8 inches; reddish brown (5YR 5/4) silt loam, dark reddish brown (5YR 3/4) moist; weak medium subangular blocky structure parting to weak fine and medium granular; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

AC—8 to 18 inches; red (2.5YR 5/6) silt loam, dark red (2.5YR 3/6) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; many fine streaks of gypsum; strong effervescence; mildly alkaline; clear wavy boundary.

C1—18 to 23 inches; light red (2.5YR 6/6) loam, red (2.5YR 4/6) moist; massive; loose; about 35 percent gypsum fragments by volume; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—23 to 41 inches; red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; massive; loose; about 60 percent gypsum fragments by volume; strong effervescence; mildly alkaline; gradual wavy boundary.

Cr—41 to 60 inches; light red (2.5YR 6/6), gypsiferous siltstone.

The depth to gypsiferous siltstone ranges from 40 to 60 inches. The A horizon has hue of 10YR to 5YR, value of 4 or 5 (3 or 4 moist), and chroma of 4 to 6. The C horizon has hue of 7.5YR to 2.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 4 to 6. Gypsum fragments make up 40 to 60 percent of this horizon by volume.

Haverson Series

The Haverson series consists of deep, well drained soils formed in calcareous, loamy alluvium. These soils are on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Haverson loam, 0 to 2 percent slopes 2,540 feet south and 810 feet west of the northeast corner of sec. 31, T. 6 S., R. 1 E.

A—0 to 4 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; slight effervescence; mildly alkaline; clear wavy boundary.

C—4 to 60 inches; light brownish gray (2.5Y 6/2) loam stratified with thin layers of fine sandy loam, silt loam, and clay loam; grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable; slight effervescence; mildly alkaline.

The control section has strata of silt loam, clay loam, fine sandy loam, or very fine sandy loam 2 to 10 inches thick. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 to 5 moist), and chroma of 2 or 3. In areas where the moist value is 3, this horizon is too thin to qualify as a mollic epipedon. The C horizon has hue of 10YR or 2.5Y.

Heath Series

The Heath series consists of deep, well drained soils formed in material weathered from limestone and calcareous sandstone. These soils are in mountain meadows. Permeability is slow. Slopes range from 2 to 15 percent.

Typical pedon of Heath silt loam, in an area of Judy-Heath-Paunsaugunt Variant complex, 2 to 25 percent slopes, 1,400 feet east and 2,300 feet north of the southwest corner of sec. 2, T. 1 S., R. 1 E.

A—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium platy structure parting to weak fine granular; slightly hard, friable; neutral; clear smooth boundary.

BA—7 to 12 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, friable; patchy films on faces of peds; neutral; gradual smooth boundary.

Bt1—12 to 20 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; weak medium prismatic structure parting to strong fine blocky; very hard, firm; shiny films on faces of peds; few pebbles; slightly acid; gradual smooth boundary.

Bt2—20 to 36 inches; brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; moderate medium prismatic structure parting to strong medium blocky; very hard, firm; patchy films on faces of peds; few pebbles; slightly acid; abrupt smooth boundary.

Bk—36 to 42 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; hard, firm; common medium and coarse accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C—42 to 60 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; massive; hard, friable; few or common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline.

The mollic epipedon ranges from 7 to 14 inches in thickness. The depth to carbonates ranges from 18 to 40 inches. The content of coarse fragments ranges from 0 to 5 percent in the A and Bt horizons and from 0 to 20 percent in the Bk and C horizons by volume. The depth to consolidated bedrock is more than 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is silt loam or loam. The Bt horizon has hue of 7.5YR or 10YR, value of 5 or 6 (3 or 4 moist), and chroma of 2 to 4. It is silty clay loam, silty clay, or clay loam. The content of clay in this horizon is as low as 35 percent in some pedons and as high as 50 percent in others. The C horizon has hue of 7.5YR or 10YR. It is silty clay loam or clay loam.

Heely Series

The Heely series consists of moderately deep, well drained soils formed in material weathered from metamorphic rock (fig. 11). These soils are on mountain prairies. Permeability is moderate. Slopes range from 6 to 30 percent.

Typical pedon of Heely channery loam, in an area of Heely-Cordeston complex, 6 to 15 percent slopes, 2,000 feet east and 700 feet north of the southwest corner of sec. 18, T. 1 N., R. 3 E.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) channery loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; about 30 percent rock fragments by volume; neutral; clear smooth boundary.

Bw1—6 to 10 inches; dark grayish brown (10YR 4/2) very flaggy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; soft, friable; about 40 percent rock fragments by volume; neutral; clear wavy boundary.

Bw2—10 to 17 inches; light olive brown (2.5Y 5/4) very flaggy sandy loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, firm; about 50 percent rock fragments by volume; neutral; gradual wavy boundary.

BC—17 to 22 inches; dark grayish brown (2.5Y 4/2) extremely flaggy sandy loam, very dark grayish brown (2.5Y 3/2) moist; weak medium subangular blocky structure; slightly hard, firm; about 65 percent rock fragments by volume; neutral; clear wavy boundary.

C—22 to 27 inches; grayish brown (2.5Y 5/2) extremely flaggy sandy loam, very dark grayish brown (2.5Y 3/2) moist; massive; slightly hard, firm; about 70 percent rock fragments by volume; neutral; gradual wavy boundary.

R—27 to 60 inches; grayish brown (2.5Y 5/2), steeply tilted metamorphic rock.

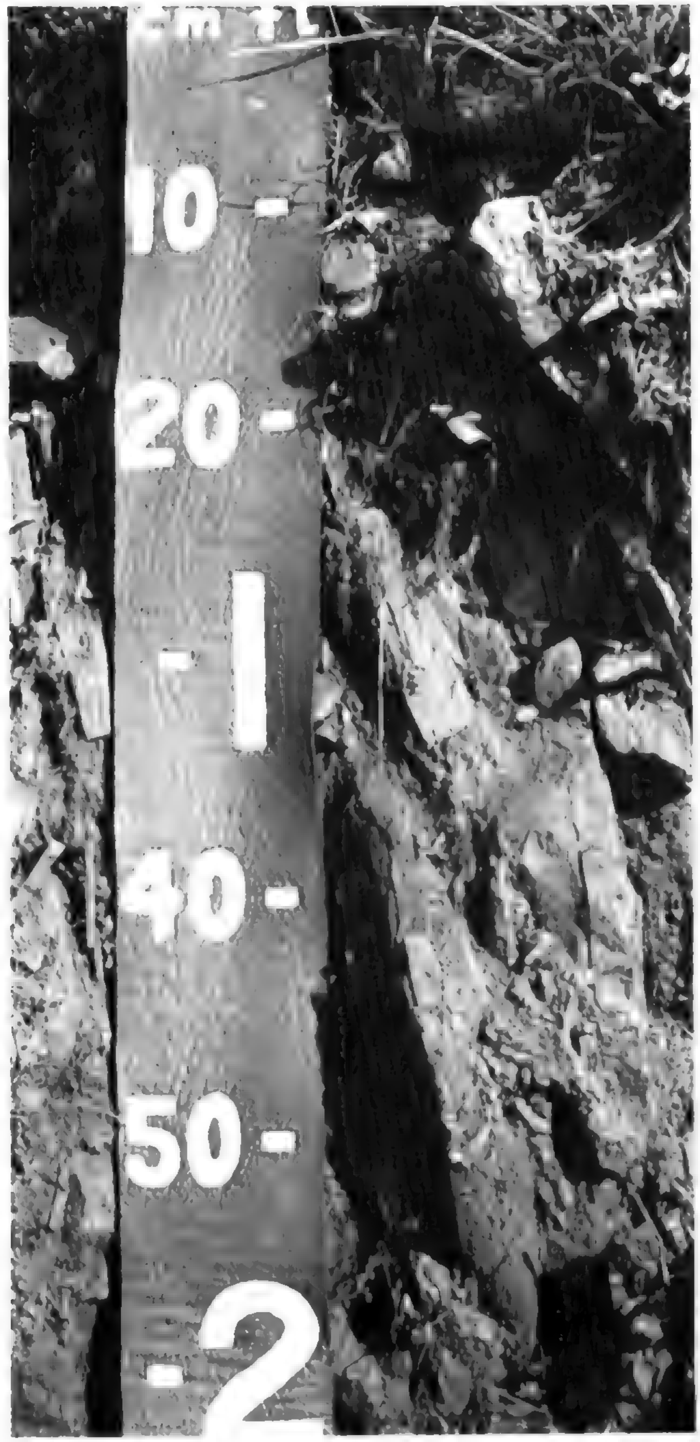


Figure 11.—Profile of Heely channery loam. Soil material is between the vertically oriented slate fragments.

The mollic epipedon ranges from 7 to 14 inches in thickness. The depth to bedrock ranges from 20 to 40 inches. Rock fragments range in size from channers to flagstones and make up 15 to 35 percent of the volume

in the upper 10 inches and 35 to 70 percent in the lower part of the subsoil and in the underlying material. In some pedons the content of mica in the control section is 25 percent by weight.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4 (2 or 3 moist), and chroma of 2 or 3. It is channery loam or channery silt loam. The Bw horizon has hue of 7.5YR to 2.5Y and chroma of 2 to 4. It is very flaggy loam, very flaggy sandy loam, very flaggy clay loam, very flaggy silt loam, or very flaggy silty clay loam. The C horizon has value of 3 to 7 (2 to 6 moist) and chroma of 2 to 5. It is extremely flaggy sandy loam, extremely flaggy loam, or extremely flaggy silt loam. Some pedons do not have a C horizon.

Hilger Series

The Hilger series consists of deep, well drained soils formed in loamy alluvium or colluvium weathered from igneous, metamorphic, and sedimentary rock. These soils are on very old stream terraces. Permeability is moderate. Slopes range from 0 to 40 percent.

Typical pedon of Hilger cobbly loam, 6 to 40 percent slopes, 1,500 feet south and 800 feet west of the northeast corner of sec. 12, T. 1 S., R. 6 E.

A—0 to 5 inches; very dark gray (10YR 3/1) cobbly loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, very friable; many fine roots; about 20 percent rock fragments by volume; neutral; clear wavy boundary.

Bt1—5 to 9 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable; many fine and medium roots; shiny films on faces of peds; about 35 percent rock fragments by volume; neutral; clear wavy boundary.

Bt2—9 to 18 inches; brown (10YR 5/3) very cobbly clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong fine and medium subangular blocky; hard, firm; common fine and medium roots; patchy films on faces of peds; about 45 percent rock fragments by volume; neutral; clear wavy boundary.

Bk—18 to 26 inches; very pale brown (10YR 7/3) very cobbly loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; common medium roots; about 55 percent rock fragments by volume; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—26 to 60 inches; light brownish gray (10YR 6/2) extremely cobbly loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; about 65 percent rock fragments by volume; strong effervescence; moderately alkaline.

The mollic epipedon is 7 to 12 inches thick. The depth to carbonates ranges from 15 to 20 inches. The content of cobbles ranges from as low as 15 percent in the A horizon to as high as 75 percent in the C horizon by volume.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4 (2 or 3 moist), and chroma of 1 or 2. The content of clay in the Bt horizon is as low as 25 percent in some pedons and as high as 35 percent in others. The C horizon has hue of 2.5Y or 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. The content of carbonates in this horizon is about 15 to 20 percent.

The Hilger soil in the Hilger-Metre complex, 10 to 40 percent slopes, is a taxadjunct to the series because it has reddish colors throughout. This difference, however, does not significantly alter the use or behavior of the soil.

Hopdraw Series

The Hopdraw series consists of deep, excessively drained soils formed in material weathered from sandstone. These soils are on mountain side slopes. Permeability is rapid. Slopes range from 10 to 75 percent.

Typical pedon of Hopdraw cobbly loamy fine sand, in an area of Hopdraw-Sawdust-Rock outcrop complex, 40 to 80 percent slopes, 2,500 feet south and 1,200 feet east of the northwest corner of sec. 27, T. 3 S., R. 1 E.

A—0 to 3 inches; grayish brown (10YR 5/2) cobbly loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; loose, very friable; about 20 percent rock fragments by volume; slight effervescence; moderately alkaline; clear wavy boundary.

C1—3 to 9 inches; pale brown (10YR 6/3) very gravelly loamy fine sand, dark brown (10YR 4/3) moist; single grain; loose; about 35 percent rock fragments by volume; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—9 to 14 inches; light gray (10YR 7/2) very gravelly loamy fine sand, grayish brown (10YR 5/2) moist; single grain; loose; about 40 percent rock fragments by volume; violent effervescence; moderately alkaline; gradual wavy boundary.

C3—14 to 44 inches; very pale brown (10YR 8/4) very gravelly loamy fine sand, very pale brown (10YR 7/4) moist; single grain; loose; about 45 percent rock fragments by volume; violent effervescence; moderately alkaline; abrupt wavy boundary.

R—44 to 60 inches; pink (7.5YR 8/4), hard sandstone; moderately alkaline.

The depth to sandstone is more than 40 inches. Rock fragments range in size from gravel to flagstones and make up 15 to 25 percent of the A horizon and 35 to 75 percent of the C horizon by volume.

The A horizon has hue of 7.5YR or 10YR, value of 4 to 6 (2 to 4 moist), and chroma of 2 or 3. It is cobbly loamy fine sand, very cobbly loamy fine sand, gravelly fine sand, or very gravelly fine sand. The C horizon has hue of 5YR to 10YR, value of 5 to 8 (4 to 7 moist), and chroma of 2 to 6. It is very gravelly loamy fine sand, very gravelly loamy sand, very gravelly fine sand, or very gravelly sand. The R horizon is hard to extremely hard sandstone. The sandstone has some cracks and fractures.

Judy Series

The Judy series consists of moderately deep, well drained soils formed in material weathered from limestone. These soils are in mountain meadows. Permeability is slow. Slopes range from 2 to 25 percent.

Typical pedon of Judy silt loam, in an area of Judy-Heath-Paunsaugunt Variant complex, 2 to 25 percent slopes, 1,450 feet east and 2,500 feet north of the southwest corner of sec. 2, T. 1 S., R. 1 E.

A—0 to 6 inches; dark brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; moderate fine and medium granular structure; soft, friable; about 5 percent rock fragments by volume; neutral; clear smooth boundary.

BA—6 to 9 inches; reddish brown (5YR 4/3) silty clay loam, dark reddish brown (5YR 3/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; about 5 percent rock fragments by volume; neutral; clear wavy boundary.

Bt—9 to 15 inches; reddish brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, firm, shiny films on faces of peds; about 5 percent rock fragments by volume; neutral; clear wavy boundary.

Bk—15 to 24 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm; about 15 percent rock fragments by volume; few fine accumulations of carbonate; strong effervescence; moderately alkaline; abrupt wavy boundary.

R—24 to 60 inches; light gray (10YR 7/2) limestone.

The mollic epipedon ranges from 7 to 12 inches in thickness. The depth to carbonates ranges from 8 to 18 inches. The depth to consolidated bedrock ranges from 20 to 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is silt loam or loam. The Bt horizon has hue of 10YR to 5YR, value of 4 to 6 (3 to 5 moist), and chroma of 3 to 6. It is silty clay loam, silty clay, clay, or clay loam. The content of clay in this horizon is as low as 35 percent in some pedons and as high as 50 percent in others. Some pedons have a C horizon.

Lail Series

The Lail series consists of deep, well drained soils formed in alluvium weathered from limestone and calcareous sandstone. These soils are on forested mountains. Permeability is slow. Slopes range from 2 to 12 percent.

Typical pedon of Lail silt loam, in an area of Stovho-Lail-Trebor complex, 2 to 12 percent slopes, 800 feet west and 150 feet north of the southeast corner of sec. 20, T. 1 S., R. 2 E.

Oi—1 inch to 0; forest litter.

A—0 to 1 inch; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; soft, very friable; slightly acid; abrupt wavy boundary.

E—1 to 6 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; weak medium subangular blocky structure parting to moderate thin and medium platy; slightly hard, friable; slightly acid; clear wavy boundary.

B/E—6 to 10 inches; reddish brown (5YR 5/4) clay, dark reddish brown (5YR 3/4) moist (B); light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist (E); moderate medium subangular blocky structure; hard, firm; patchy films on faces of peds; neutral; clear wavy boundary.

Bt1—10 to 20 inches; reddish brown (5YR 5/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, very firm; shiny films on

faces of peds; neutral; clear wavy boundary.

Bt2—20 to 26 inches; reddish brown (5YR 5/4) clay, dark reddish brown (5YR 3/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm; patchy films on faces of peds; few fine accumulations of carbonate; slight effervescence; mildly alkaline; gradual wavy boundary.

Bk—26 to 34 inches; light red (2.5YR 6/6) clay loam, red (2.5YR 5/6) moist; weak coarse subangular blocky structure; very hard, firm; common fine accumulations of carbonate; about 5 percent limestone fragments by volume; strong effervescence; mildly alkaline; gradual wavy boundary.

C—34 to 60 inches; red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; massive; very hard, firm; about 10 percent limestone fragments by volume; strong effervescence; moderately alkaline.

The depth to carbonates ranges from 20 to 32 inches. The content of rock fragments ranges from 0 to 15 percent by volume. Typically, the depth to consolidated bedrock is more than 60 inches.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is dominantly silt loam but is loam in some pedons. The E horizon has hue of 10YR to 5YR and value of 6 or 7 (4 to 6 moist). It is loam or silt loam. The Bt horizon has hue of 5YR or 2.5YR, value of 4 to 6 (3 to 5 moist), and chroma of 3 or 4. The content of clay in this horizon is as low as 35 percent in some pedons and as high as 50 percent in others. The C horizon has hue of 5YR or 2.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 4 to 6. It is clay loam, sandy clay loam, loam, or sandy loam.

Lakoa Series

The Lakoa series consists of deep, well drained soils formed in material weathered from sandstone. These soils are on forested mountains. Permeability is moderate. Slopes range from 3 to 40 percent.

Typical pedon of Lakoa very fine sandy loam, in an area of Rockoa-Lakoa-Rock outcrop complex, 10 to 40 percent slopes, 200 feet south and 85 feet east of the northwest corner of sec. 19, T. 4 S., R. 1 E.

Oi—1 inch to 0; forest litter.

A—0 to 5 inches; gray (10YR 5/1) very fine sandy loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak medium platy; soft, very friable; slightly acid; abrupt smooth boundary.

B/A—5 to 11 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist (Bt); pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist (E); weak medium subangular blocky structure; hard, friable; slightly acid; clear smooth boundary.

Bt1—11 to 18 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to strong medium blocky; very hard, firm; shiny films on faces of peds; slightly acid; clear smooth boundary.

Bt2—18 to 22 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; patchy films on faces of peds; slightly acid; clear smooth boundary.

Bk1—22 to 26 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; very hard, friable; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

Bk2—26 to 33 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; hard, friable; about 10 percent gravel by volume; many fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C—33 to 60 inches; very pale brown (10YR 7/3) gravelly clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; about 25 percent gravel by volume; common medium accumulations of carbonate; strong effervescence; mildly alkaline.

The depth to carbonates ranges from 20 to 30 inches. The depth to bedrock ranges from 40 to more than 60 inches. The content of gravel ranges, by volume, from 0 to 15 percent in the Bk horizon and from 15 to 40 percent in the C horizon.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It is loam, silt loam, or very fine sandy loam. Some pedons have a thin E horizon. The Bt horizon has hue of 7.5YR or 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is clay loam or sandy clay loam. The content of clay in this horizon is as low as 20 percent in some pedons and as high as 30 percent in others. The C horizon has hue of 7.5YR or 10YR, value of 5 to 7 (4 to 6 moist),

and chroma of 2 to 4. It is gravelly clay loam or gravelly loam

Marshbrook Series

The Marshbrook series consists of deep, poorly drained soils formed in alluvial material weathered from slate, quartzite, and schist. These soils are on flood plains in mountain valleys. Permeability is moderately slow. Slopes range from 0 to 4 percent.

Typical pedon of Marshbrook loam, in an area of Cordeston-Marshbrook loams, 0 to 6 percent slopes, 1,300 feet south and 1,100 feet east of the northwest corner of sec. 32, T. 1 N., R. 3 E.

A1—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; soft, very friable; neutral; clear smooth boundary.

A2—9 to 25 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; common medium prominent reddish brown (5YR 4/4 moist) mottles; weak medium subangular blocky structure; hard, friable; neutral; gradual wavy boundary.

Bg—25 to 41 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; common medium prominent reddish brown (5YR 4/4 moist) mottles; very weak coarse subangular blocky structure; hard, friable; neutral; gradual wavy boundary.

Cg1—41 to 50 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; many medium prominent reddish brown (5YR 4/4 moist) mottles; massive; hard, friable; about 25 percent gravel by volume; neutral; gradual wavy boundary.

Cg2—50 to 60 inches; dark gray (10YR 4/1) gravelly sandy loam, very dark gray (10YR 3/1) moist; common fine and medium prominent reddish brown (5YR 4/4 moist) mottles; massive; slightly hard, friable; about 15 percent rock fragments by volume; neutral.

The mollic epipedon ranges from 24 to 40 inches in thickness. Carbonates are below a depth of 40 inches. Rock fragments range in size from gravel to cobbles and make up 0 to 10 percent of the control section by volume.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 to 3. It is loam or clay loam. The Bg horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 or 2. It has common or many distinct or prominent mottles. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 6 moist), and chroma of 1 to 3. It is gravelly loam or gravelly sandy loam below a depth of 40 inches.

Metre Series

The Metre series consists of moderately deep, well drained soils formed in clayey material weathered from mudstone or shale. These soils are on uplands. When dry, they are characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Gilgai relief is prominent. Permeability is very slow. Slopes range from 2 to 15 percent.

Typical pedon of Metre clay, in an area of Norrest-Fairburn-Metre complex, 9 to 40 percent slopes, 1,400 feet south and 100 feet west of the northeast corner of sec. 26, T. 4 S., R. 6 E.

A—0 to 5 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; hard, friable; neutral; clear smooth boundary.

Bw1—5 to 10 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to strong medium subangular blocky; very hard, very firm; slight effervescence; mildly alkaline; clear wavy boundary.

Bw2—10 to 18 inches; dark gray (10YR 4/1) clay, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; very hard, extremely firm; few intersecting slickensides; slight effervescence; moderately alkaline; clear wavy boundary.

Bw3—18 to 26 inches; dark gray (10YR 4/1) and light reddish brown (5YR 6/4) clay, very dark grayish brown (10YR 3/2) and reddish brown (5YR 5/4) moist; weak coarse prismatic structure; very hard, extremely firm; few intersecting slickensides; strong effervescence; moderately alkaline; clear wavy boundary.

Bk—26 to 36 inches; reddish brown (5YR 5/4) and reddish gray (5YR 5/2) clay, reddish brown (5YR 4/4) and dark reddish gray (5YR 4/2) moist; weak very coarse prismatic structure; very hard, extremely firm; few intersecting slickensides; common medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—36 to 60 inches; reddish brown (5YR 5/4), soft, clayey mudstone.

The depth to soft mudstone or shale ranges from 20 to 40 inches. The depth to carbonates ranges from 0 to 10 inches. The mollic epipedon ranges from 8 to 20 inches in thickness.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The Bw horizon has hue of 2.5Y to 5YR, value of 3 to 6 (2 to 5 moist), and chroma of 1 to 4. The Cr horizon is soft, clayey mudstone or shale.

Mocmont Series

The Mocmont series consists of deep, well drained soils formed in colluvium and material weathered from granite. These soils are on forested mountains. Permeability is moderate. Slopes range from 2 to 60 percent.

Typical pedon of Mocmont gravelly loam, in an area of Mocmont-Rock outcrop complex, 10 to 40 percent slopes, 1,650 feet north and 1,400 feet east of the southwest corner of sec. 1, T. 3 S., R. 5 E.

Oi—1 inch to 0; forest litter.

A—0 to 2 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; about 20 percent rock fragments by volume; neutral; abrupt smooth boundary.

E—2 to 12 inches; very pale brown (10YR 7/3) gravelly loam, brown (10YR 5/3) moist; weak thin platy structure parting to weak fine granular; soft, very friable; about 20 percent rock fragments by volume; medium acid; abrupt smooth boundary.

B/E—12 to 18 inches; light yellowish brown (10YR 6/4) very gravelly clay loam, dark yellowish brown (10YR 4/4) moist (B); very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) moist (E); moderate medium subangular blocky structure; slightly hard, friable; about 40 percent rock fragments by volume; slightly acid; gradual wavy boundary.

Bt1—18 to 23 inches; light yellowish brown (10YR 6/4) very gravelly clay loam, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; shiny films on faces of peds; about 40 percent rock fragments by volume; slightly acid; gradual wavy boundary.

Bt2—23 to 38 inches; light yellowish brown (10YR 6/4) very gravelly clay loam, yellowish brown (10YR 5/4) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable; shiny films on faces of peds; about 45 percent rock fragments by volume; neutral; gradual wavy boundary.

Bt3—38 to 44 inches; light yellowish brown (10YR 6/4) very gravelly clay loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; patchy films on faces of peds; about 50 percent rock fragments by volume; neutral; gradual wavy boundary.

Bt4—44 to 50 inches; light yellowish brown (10YR 6/4) very gravelly clay loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; very hard, firm; about 55 percent rock fragments by volume; neutral; gradual wavy boundary.

BC—50 to 60 inches; light yellowish brown (10YR 6/4) very gravelly loam, yellowish brown (10YR 5/4) moist; very weak coarse subangular blocky structure; very hard, firm; about 60 percent rock fragments by volume; neutral.

Rock fragments range in size from gravel to cobbles and make up 10 to 25 percent of the surface layer and 35 to 70 percent of the subsoil by volume. Typically, the depth to consolidated bedrock is more than 60 inches, but it ranges from 40 to more than 60 inches.

The A horizon has value of 4 to 6 (2 or 3 moist) and chroma of 1 or 2. The E horizon has value of 5 to 8 (4 to 6 moist) and chroma of 2 to 4. The A and E horizons are gravelly loam, gravelly sandy loam, cobbly loam, cobbly sandy loam, or sandy loam. The Bt horizon has value of 5 or 6 (4 or 5 moist) and chroma of 3 or 4. It is very gravelly clay loam, very cobbly clay loam, very gravelly loam, or very cobbly loam. The content of clay in this horizon is as low as 20 percent in some pedons and as high as 35 percent in others. The BC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 4 to 6. It is very gravelly clay loam, extremely gravelly clay loam, very gravelly loam, extremely gravelly loam, or extremely cobbly sandy clay loam.

Nevee Series

The Nevee series consists of deep, well drained soils formed in material weathered from reddish siltstone, sandstone, and silty shale. These soils are on uplands, terraces, and alluvial fans. Permeability is moderate. Slopes range from 2 to 30 percent slopes.

Typical pedon of Nevee silt loam, in an area of Spearfish-Nevee silt loams, 9 to 30 percent slopes,

1,150 feet west and 50 feet south of the northeast corner of sec. 21, T. 1 N., R. 7 E.

A1—0 to 4 inches; yellowish red (5YR 4/6) silt loam, reddish brown (5YR 4/4) moist; weak fine granular structure; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

A2—4 to 8 inches; yellowish red (5YR 5/6) silt loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

C1—8 to 36 inches; reddish yellow (5YR 6/6) silt loam, yellowish red (5YR 4/6) moist; massive; hard, firm; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—36 to 60 inches; light red (2.5YR 6/6) loam, red (2.5YR 4/6) moist; massive; very hard, firm; strong effervescence; moderately alkaline.

The depth to carbonates is less than 10 inches. The A horizon has hue of 10YR to 5YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 6. It typically is silt loam but is loam, very fine sandy loam, or channery loam in some pedons. Some pedons have an AC horizon. The C horizon has hue of 2.5YR to 7.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 3 to 6. It is loam, silt loam, very fine sandy loam, or channery loam.

Nihill Series

The Nihill series consists of deep, well drained soils formed in calcareous, gravelly alluvium. These soils are on terraces. Permeability is moderately rapid. Slopes range from 6 to 50 percent.

Typical pedon of Nihill gravelly loam, in an area of Zigweid-Nihill complex, 6 to 15 percent slopes, 2,500 feet east and 1,300 feet south of the northwest corner of sec. 14, T. 5 S., R. 3 E.

A1—0 to 3 inches; grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, friable; about 30 percent gravel by volume; slight effervescence; mildly alkaline; clear smooth boundary.

A2—3 to 7 inches; light brownish gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak very fine, fine, and medium granular structure; soft, friable; about 35 percent gravel by volume; strong effervescence; mildly alkaline; clear smooth boundary.

C—7 to 60 inches; very pale brown (10YR 7/3) very gravelly loam, pale brown (10YR 6/3) moist; massive; soft, very friable; about 55 percent gravel by volume; violent effervescence; moderately alkaline.

The content of gravel, by volume, is 15 to 35 percent in the A horizon and 35 to 70 percent in the C horizon. The A horizon has chroma of 2 or 3. It generally is gravelly loam but is gravelly sandy loam or cobbly loam in some pedons. The C horizon has value of 6 or 7 (4 to 6 moist) and chroma of 2 to 4. It is very gravelly loam or extremely gravelly sandy loam.

Norrest Series

The Norrest series consists of moderately deep, well drained soils formed in material weathered from mudstone. These soils are on uplands. Permeability is moderately slow. Slopes range from 2 to 30 percent.

Typical pedon of Norrest cobbly silty clay loam, in an area of Norrest-Fairburn-Metre complex, 9 to 40 percent slopes, 2,250 feet east and 1,950 feet north of the southwest corner of sec. 24, T. 4 S., R. 6 E.

A—0 to 4 inches; grayish brown (10YR 5/2) cobbly silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, friable; about 25 percent rock fragments by volume; mildly alkaline; clear smooth boundary.

Bt—4 to 8 inches; brown (10YR 5/3) cobbly silty clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, firm; shiny films on faces of peds; about 20 percent rock fragments by volume; mildly alkaline; clear wavy boundary.

Btk—8 to 16 inches; very pale brown (10YR 7/3) silty clay, brown (10YR 5/3) moist; strong medium prismatic structure parting to moderate medium blocky; very hard, firm; patchy films on faces of peds; about 5 percent rock fragments by volume; violent effervescence; moderately alkaline; gradual wavy boundary.

BC—16 to 24 inches; very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; about 10 percent soft mudstone fragments by volume; strong effervescence; moderately alkaline; gradual wavy boundary.

C—24 to 32 inches; very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; massive;

hard, friable; about 25 percent soft mudstone fragments by volume; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Cr—32 to 60 inches; very pale brown (10YR 8/3), soft mudstone; strong effervescence; moderately alkaline.

The depth to bedrock ranges from 20 to 40 inches. The depth to carbonates ranges from 2 to 20 inches. Rock fragments range in size from gravel to cobbles and make up 5 to 25 percent of the A and Bt horizons by volume.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is cobbly silty clay loam, cobbly clay loam, silty clay loam, or clay loam. The Bt horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is clay loam, silty clay loam, silty clay, cobbly silty clay, or clay. The content of clay in this horizon is as low as 35 percent in some pedons and as high as 45 percent in others. Some pedons do not have a C horizon.

Pactola Series

The Pactola series consists of deep, well drained soils formed in material weathered from steeply tilted metamorphic rock. These soils are on forested mountains. Permeability is moderate. Slopes range from 6 to 60 percent.

Typical pedon of Pactola channery loam, in an area of Pactola-Virkula-Rock outcrop complex, 10 to 40 percent slopes, 1,500 feet east and 200 feet north of the southwest corner of sec. 14, T. 2 N., R. 4 E.

Oi—1 inch to 0; forest litter.

A—0 to 1 inch; dark gray (10YR 4/1) channery loam, black (10YR 2/1) moist; weak fine and medium granular structure; soft, very friable; about 15 percent rock fragments by volume; slightly acid; abrupt smooth boundary.

E—1 to 11 inches; very pale brown (10YR 7/3) channery loam, brown (10YR 5/3) moist; weak thin platy structure; soft, very friable; about 30 percent rock fragments by volume; medium acid; clear wavy boundary.

B/E—11 to 18 inches; pale brown (10YR 6/3) very channery clay loam, dark brown (10YR 4/3) moist (B); very pale brown (10YR 7/3) channery loam, brown (10YR 5/3) moist (E); weak fine and medium subangular blocky structure; slightly hard, friable; about 40 percent rock fragments by volume; medium acid; clear wavy boundary.

Bt—18 to 42 inches; yellowish brown (10YR 5/4) extremely channery clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, firm; shiny films on faces of peds; about 65 percent rock fragments by volume; medium acid; diffuse wavy boundary.

R—42 to 60 inches; grayish brown (2.5Y 5/2), steeply tilted, fractured metamorphic rock.

The depth to fractured bedrock is 40 to 60 inches. Rock fragments range in size from channers to flagstones and make up 15 to 30 percent of the A and E horizons and 40 to 70 percent of the Bt horizon by volume.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly channery loam but is channery silt loam in some pedons. Some pedons do not have an O or A horizon. The E horizon has hue of 10YR or 2.5Y, value of 6 or 7 (4 or 5 moist), and chroma of 2 or 3. It is channery loam or channery silt loam. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 3 or 4. It is extremely channery clay loam or extremely channery silty clay loam. The content of clay in this horizon is as low as 27 percent in some pedons and as high as 35 percent in others. Some pedons have a C horizon.

Paunsaugunt Series

The Paunsaugunt series consists of shallow, well drained soils formed in material weathered from limestone and calcareous sandstone. These soils are on mountains and uplands. Permeability is moderate. Slopes range from 2 to 40 percent.

Typical pedon of Paunsaugunt gravelly loam, in an area of Paunsaugunt-Rock outcrop complex, 6 to 30 percent slopes, 2,440 feet west and 1,980 feet south of the northeast corner of sec. 28, T. 2 N., R. 7 E.

A1—0 to 2 inches; dark brown (10YR 4/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; about 30 percent rock fragments by volume; strong effervescence; mildly alkaline; abrupt smooth boundary.

A2—2 to 6 inches; brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine and medium granular; soft, very friable; about 35 percent rock fragments by volume; strong effervescence; mildly alkaline; clear smooth boundary.

C—6 to 11 inches; brown (10YR 5/3) very gravelly loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; soft, very friable; about 45 percent rock fragments by volume; strong effervescence; mildly alkaline; abrupt wavy boundary.

R—11 to 60 inches; light brown (7.5YR 6/4) and pink (7.5YR 8/4) limestone bedrock.

The mollic epipedon ranges from 5 to 12 inches in thickness. The depth to bedrock ranges from 10 to 20 inches. Rock fragments range in size from gravel to cobbles and make up 25 to 50 percent of the volume.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4 moist, and chroma of 2 or 3. The C horizon has hue of 7.5YR or 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 2 or 3.

Paunsaugunt Variant

The Paunsaugunt Variant consists of shallow, well drained soils that formed in material weathered from limestone and calcareous sandstone. These soils are in mountain meadows. Permeability is moderate. Slopes range from 2 to 25 percent.

Typical pedon of Paunsaugunt Variant gravelly silt loam, in an area of Judy-Heath-Paunsaugunt Variant complex, 2 to 25 percent slopes, 1,500 feet east and 1,650 feet south of the northwest corner of sec. 2, T. 1 S., R. 1 E.

A—0 to 4 inches; dark brown (7.5YR 4/2) gravelly silt loam, dark brown (7.5YR 3/2) moist; weak fine and medium granular structure; soft, friable; about 25 percent rock fragments by volume; neutral; clear smooth boundary.

AC—4 to 11 inches; dark reddish gray (5YR 4/2) very gravelly loam, dark reddish brown (5YR 3/2) moist; moderate fine and medium subangular blocky structure; soft, friable; about 45 percent rock fragments by volume; violent effervescence; mildly alkaline; clear wavy boundary.

R—11 to 60 inches; light gray (10YR 7/2) limestone.

The mollic epipedon ranges from 5 to 12 inches in thickness. The depth to bedrock ranges from 10 to 20 inches. Rock fragments range in size from gravel to cobbles and make up 15 to 40 percent of the surface layer and 35 to 50 percent of the AC horizon by volume.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is gravelly loam or gravelly silt loam. The AC horizon has hue of 2.5YR to 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. Some pedons have a C horizon.

Pierre Series

The Pierre series consists of moderately deep, well drained soils formed in clayey material weathered from shale. These soils are on uplands. When dry, they are characterized by cracks that are 0.5 inch to 2.0 inches wide and several feet long and extend through the subsoil. Gilgai relief is prominent. Permeability is very slow. Slopes range from 2 to 9 percent.

Typical pedon of Pierre clay, in an area of Pierre-Grummit clays, 2 to 9 percent slopes, 960 feet east and 300 feet north of the southwest corner of sec. 35, T. 6 S., R. 1 E.

A—0 to 4 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure parting to strong fine granular; slightly hard, firm; strong effervescence; mildly alkaline; clear wavy boundary.

Bw—4 to 16 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; very hard, firm; few intersecting slickensides; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk—16 to 24 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; very hard, firm; few intersecting slickensides; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C1—24 to 27 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; about 15 percent gray (N 5/0) and dark gray (N 4/0), soft shale fragments by volume; common distinct yellowish brown stains; massive; very hard, firm; few fine accumulations of carbonate, gypsum, and salts; strong effervescence; mildly alkaline; clear wavy boundary.

C2—27 to 32 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; about 50 percent gray (N 5/0) and dark gray (N 4/0), soft shale fragments by volume; distinct yellowish brown stains; massive; hard, friable; few fine accumulations of carbonate and salts; mildly alkaline; gradual wavy boundary.

Cr—32 to 60 inches; gray (2.5Y 5/0), soft shale; slightly acid.

The depth to soft shale ranges from 20 to 40 inches. Gypsum and other salts commonly are in the shale seams.

The A horizon has hue of 10YR to 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 to 3. It is clay or silty clay. The B horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. The content of clay in this horizon is as low as 60 percent in some pedons and as high as 70 percent in others. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. It has few or common accumulations of gypsum and other salts in most pedons.

Redbird Series

The Redbird series consists of deep, well drained soils that formed in alluvium derived from limestone and calcareous sandstone. These soils are in mountain meadows. Permeability is moderate. Slopes range from 2 to 9 percent.

Typical pedon of Redbird silt loam, in an area of Redbird-Heath silt loams, 2 to 9 percent slopes, 2,200 feet north and 2,000 feet east of the southwest corner of sec. 36, T. 1 S., R. 2 E.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, very friable; about 5 percent rock fragments by volume; neutral; abrupt smooth boundary.

A2—3 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; about 10 percent rock fragments by volume; neutral; clear smooth boundary.

Bt1—7 to 12 inches; dark grayish brown (10YR 4/2) very cobbly silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium blocky structure; hard, firm; shiny films on faces of peds; about 50 percent rock fragments by volume; neutral; clear smooth boundary.

Bt2—12 to 20 inches; very dark grayish brown (10YR 3/2) extremely cobbly silty clay loam, very dark brown (10YR 2/2) moist; moderate medium blocky structure; very hard, firm; patchy films on faces of peds; about 65 percent rock fragments by volume; neutral; abrupt smooth boundary.

Bk—20 to 24 inches; grayish brown (10YR 5/2) extremely cobbly silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; slightly hard, friable; about 75 percent rock fragments by volume; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

C—24 to 60 inches; pale brown (10YR 6/3) extremely cobbly loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable; about 80 percent rock fragments by volume; strong effervescence; mildly alkaline.

The mollic epipedon ranges from 16 to 32 inches in thickness. The depth to carbonates ranges from 14 to 26 inches. Rock fragments range in size from gravel to cobbles and make up 0 to 15 percent of the surface layer and 35 to 75 percent of the subsoil and underlying material by volume. The depth to consolidated bedrock is more than 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 3 or 4 (2 or 3 moist), and chroma of 1 or 2. It is silt loam or loam. The Bt horizon has hue of 5YR to 10YR, value of 3 to 5 (2 to 4 moist), and chroma of 2 or 3. It is very cobbly or extremely cobbly silty clay loam or clay loam. The content of clay in this horizon is as low as 27 percent in some pedons and as high as 35 percent in others. The C horizon has hue of 2.5YR to 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is extremely cobbly loam or extremely cobbly clay loam.

Rekop Series

The Rekop series consists of shallow, well drained or somewhat excessively drained soils that formed in material weathered from reddish, gypsiferous siltstone and white gypsum. These soils are on uplands. Permeability is moderate. Slopes range from 6 to 60 percent.

Typical pedon of Rekop loam, in an area of Gypnevee-Rekop-Rock outcrop complex, 6 to 15 percent slopes, 2,600 feet west and 300 feet south of the northeast corner of sec. 29, T. 2 N., R. 7 E.

A—0 to 4 inches; reddish brown (5YR 5/3) loam, reddish brown (5YR 4/3) moist; weak fine granular structure; soft, friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

C1—4 to 7 inches; light reddish brown (5YR 6/4) loam, reddish brown (5YR 4/4) moist; very weak fine and medium subangular blocky structure; soft, very friable; strong effervescence; about 30 percent gypsum fragments by volume; mildly alkaline; clear wavy boundary.

C2—7 to 12 inches; pink (5YR 7/4) loam, reddish brown

(5YR 5/4) moist; massive; soft, very friable; slight effervescence; about 50 percent gypsum fragments by volume; mildly alkaline; gradual wavy boundary.

Cr—12 to 60 inches; white gypsum.

The depth to bedrock ranges from 10 to 20 inches. The A horizon has hue of 10YR to 5YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is dominantly loam but is silt loam in some pedons. The C horizon has hue of 7.5YR to 2.5YR. Gypsum makes up as much as 60 percent of this horizon by volume.

Rockoa Series

The Rockoa series consists of deep, well drained soils formed in material weathered from interbedded sandstone and shale. These soils are on forested mountain side slopes. Permeability is moderate. Slopes range from 6 to 60 percent.

Typical pedon of Rockoa cobbly fine sandy loam, in an area of Rockoa-Rock outcrop complex, 25 to 60 percent slopes, 1,400 feet east and 200 feet north of the southwest corner of sec. 11, T. 1 N., R. 7 E.

Oi—1 inch to 0; forest litter.

A—0 to 2 inches; dark grayish brown (10YR 4/2) cobbly fine sandy loam, very dark brown (10YR 2/2) moist; very weak fine granular structure; soft, very friable; about 20 percent rock fragments by volume; neutral; abrupt smooth boundary.

E—2 to 6 inches; light brownish gray (10YR 6/2) cobbly fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to very weak thin platy; soft, friable; about 30 percent rock fragments by volume; neutral; abrupt smooth boundary.

B/E—6 to 9 inches; light brown (7.5YR 6/4) very cobbly clay loam, dark brown (7.5YR 4/4) moist (B); light brownish gray (10YR 6/2) cobbly fine sandy loam, dark grayish brown (10YR 4/2) moist (E); moderate medium subangular blocky structure; slightly hard, friable; about 40 percent rock fragments by volume; neutral; clear smooth boundary.

Bt—9 to 22 inches; light brown (7.5YR 6/4) and pink (7.5YR 7/4) very cobbly clay loam, dark brown (7.5YR 4/4) and brown (7.5YR 5/4) moist; moderate fine and medium subangular blocky structure; hard, firm; shiny films on faces of peds; about 40 percent rock fragments by volume; slightly acid; clear wavy boundary.

BC—22 to 26 inches; pink (7.5YR 7/4) and pinkish gray (7.5YR 7/2) very cobbly clay loam, brown (7.5YR 5/4 and 5/2) moist; weak medium subangular blocky structure; slightly hard, friable; about 50 percent rock fragments by volume; medium acid; clear wavy boundary.

C—26 to 60 inches; pinkish white (7.5YR 8/2) extremely cobbly fine sandy loam, pinkish gray (7.5YR 7/2) moist; massive; soft, friable; about 65 percent rock fragments by volume; medium acid.

Generally, the depth to carbonates is more than 60 inches. In some pedons, however, it is 40 to 60 inches. Rock fragments range in size from gravel to boulders and make up 20 to 50 percent of the solum and 40 to 75 percent of the C horizon by volume. Bedrock is at a depth of 40 to 60 inches in some pedons.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. The A and E horizons are cobbly fine sandy loam or cobbly loam. The Bt horizon has hue of 5YR to 10YR, value of 5 to 7, and chroma of 3 to 6. It is very cobbly clay loam or very cobbly sandy clay loam. The C horizon has hue of 5YR to 10YR, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 6. It is extremely cobbly fine sandy loam, extremely cobbly loam, or extremely cobbly sandy clay loam.

Satanta Series

The Satanta series consists of deep, well drained soils that formed in loamy alluvium. These soils are on uplands. Permeability is moderate. Slopes range from 2 to 10 percent.

Typical pedon of Satanta loam, in an area of Satanta-Canyon loams, 6 to 15 percent slopes, 200 feet east and 400 feet south of the northwest corner of sec. 14, T. 2 N., R. 7 E.

A—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

BA—6 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, very friable; slightly acid; clear smooth boundary.

Bt1—9 to 19 inches; yellowish brown (10YR 5/4) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; shiny films on faces of peds; neutral; clear smooth boundary.

Bt2—19 to 26 inches; yellowish brown (10YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; patchy films on faces of peds; neutral; abrupt wavy boundary.

Bk—26 to 34 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate medium prismatic structure; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—34 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; strong effervescence; mildly alkaline.

The mollic epipedon ranges from 8 to 18 inches in thickness. The depth to carbonates ranges from 15 to 28 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly loam but is very fine sandy loam or fine sandy loam in some pedons. The Bt horizon has hue of 7.5YR to 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 2 to 4. It is clay loam, sandy clay loam, or loam. The C horizon has hue of 2.5Y or 10YR.

Sawdust Series

The Sawdust series consists of deep, well drained soils formed in residuum and colluvial sediments weathered from limestone and calcareous sandstone. These soils are on mountains. Permeability is moderate. Slopes range from 10 to 80 percent.

Typical pedon of Sawdust channery loam, in an area of Sawdust-Vanocker-Paunsaugunt complex, 10 to 40 percent slopes, 2,600 feet north and 1,900 feet east of the southwest corner of sec. 20, T. 4 S., R. 3 E.

A—0 to 4 inches; dark grayish brown (10YR 4/2) channery loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; about 30 percent rock fragments by volume; strong effervescence; mildly alkaline; clear wavy boundary.

AC—4 to 8 inches; pale brown (10YR 6/3) very channery loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, friable; about 50 percent rock fragments by volume; strong effervescence; moderately alkaline; clear wavy boundary.

C1—8 to 15 inches; light yellowish brown (10YR 6/4) very channery loam, dark yellowish brown (10YR 4/4) moist; massive; soft, friable; about 55 percent rock fragments by volume; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—15 to 26 inches; very pale brown (10YR 7/4) extremely channery loam, light yellowish brown (10YR 6/4) moist; massive; soft, friable; about 70 percent rock fragments by volume; strong effervescence; moderately alkaline; gradual wavy boundary.

C3—26 to 60 inches; yellow (10YR 7/6) extremely channery sandy loam, brownish yellow (10YR 6/6) moist; massive; soft, friable; about 80 percent rock fragments by volume; strong effervescence; moderately alkaline.

Rock fragments range in size from gravel to flagstones and make up 5 to 45 percent of the A horizon and 35 to 90 percent of the AC and C horizons by volume. Carbonates are leached to a depth of 4 inches in some pedons.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 6 (2 to 4 moist), and chroma of 1 to 3. It is gravelly loam, gravelly silt loam, channery loam, or channery silt loam. The C horizon has hue of 2.5YR to 10YR, value of 5 to 8 (4 to 7 moist), and chroma of 3 to 6. It is extremely channery sandy loam, extremely channery silt loam, extremely channery silty clay loam, extremely channery loam, or extremely channery clay loam. Some pedons have a thin O horizon, and some do not have an AC horizon.

Shirttail Series

The Shirttail series consists of deep, well drained soils formed in material weathered from metamorphic and igneous rocks. These soils are on mountains. Permeability is moderate. Slopes range from 10 to 40 percent.

Typical pedon of Shirttail channery loam, 10 to 40 percent slopes, 1,400 feet east and 1,900 feet south of the northwest corner of sec. 16, T. 5 S., R. 5 E.

A—0 to 6 inches; dark grayish brown (10YR 4/2) channery loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, friable; about 20 percent rock fragments by volume; medium acid; clear smooth boundary.

Bt1—6 to 11 inches; strong brown (7.5YR 5/6) very channery clay loam, dark brown (7.5YR 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; shiny films on faces of peds; about 35 percent rock fragments by volume; slightly acid; gradual wavy boundary.

Bt2—11 to 18 inches; yellowish brown (10YR 5/4) very channery clay loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; hard, friable; patchy films on faces of peds; about 45 percent rock fragments by volume; slightly acid; gradual wavy boundary.

BC—18 to 24 inches; yellowish brown (10YR 5/6) very channery loam, dark yellowish brown (10YR 4/6) moist; very weak fine and medium subangular blocky structure; soft, very friable; about 40 percent rock fragments by volume; neutral; gradual wavy boundary.

C—24 to 44 inches; yellowish brown (10YR 5/4) very channery loamy fine sand, dark yellowish brown (10YR 4/4) moist; single grain; loose; about 45 percent rock fragments by volume; neutral; abrupt wavy boundary.

R—44 to 60 inches; consolidated metamorphic rock.

The mollic epipedon ranges from 6 to 10 inches in thickness. Rock fragments range in size from cobbles to flagstones and make up from 15 to 30 percent of the surface layer to 35 to 70 percent of the control section by volume. The depth to consolidated bedrock is 40 to 60 inches. Some pedons are calcareous below a depth of 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 4 to 6 (2 or 3 moist), and chroma of 1 or 2. It is channery loam or channery sandy loam. The Bt horizon has hue of 5YR to 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 3 to 6. It is very channery clay loam or very channery sandy clay loam. The content of clay in this horizon is as low as 27 percent in some pedons and as high as 35 percent in others. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 4 to 6. It is very channery loamy fine sand, very channery fine sandy loam, or very channery loam.

Spearfish Series

The Spearfish series consists of shallow, excessively drained soils formed in material weathered from reddish siltstone and silty shale. These soils are on uplands. Permeability is moderate. Slopes range from 9 to 40 percent.

Typical pedon of Spearfish silt loam, in an area of Spearfish-Rock outcrop complex, 25 to 60 percent slopes, 1,350 feet south and 280 feet west of the northeast corner of sec. 12, T. 6 S., R. 2 E.

A—0 to 5 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; strong effervescence; moderately alkaline; clear wavy boundary.

AC—5 to 8 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; weak fine granular structure; soft, very friable; violent effervescence; moderately alkaline; clear wavy boundary.

C—8 to 12 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; massive; soft, very friable; few small soft shale and siltstone fragments; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—12 to 60 inches; reddish yellow (5YR 6/6), soft, silty shale.

The depth to bedrock ranges from 6 to 20 inches. The control section is dominantly silt loam but is loam, very fine sandy loam, or silty clay loam in some pedons.

The A horizon has hue of 2.5YR to 10YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. In areas where it is dark, this horizon is too thin to qualify as a mollic epipedon. The C horizon has hue of 2.5YR to 7.5YR, value of 5 or 6 (3 to 5 moist), and chroma of 4 to 6. In some pedons it has gypsum crystals. The Cr horizon is soft siltstone or silty shale. In some pedons seams of gypsum are between bedding planes and fractures.

Stovho Series

The Stovho series consists of deep, well drained soils formed in material weathered from limestone and calcareous sandstone. These soils are on forested mountains. Permeability is slow. Slopes range from 2 to 40 percent.

Typical pedon of Stovho silt loam, in an area of Stovho-Lail-Trebor complex, 2 to 12 percent slopes, 1,500 feet east and 2,000 feet north of the southwest corner of sec. 18, T. 2 S., R. 3 E.

Oi—1 inch to 0; forest litter.

A—0 to 2 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium platy structure; soft, very friable; medium acid; clear smooth boundary.

E—2 to 6 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; weak thin and medium platy structure; soft, very friable; medium acid; clear wavy boundary.

B/E—6 to 8 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist (B); light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2)

moist (E); weak medium prismatic structure parting to moderate fine and medium blocky; slightly hard, friable; slightly acid; clear wavy boundary.

Bt—8 to 17 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to strong medium blocky; hard, firm; shiny films on faces of peds; slightly acid; clear wavy boundary.

Bk—17 to 30 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure; hard, firm; about 10 percent rock fragments by volume; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—30 to 60 inches; yellow (10YR 7/6) channery silty clay loam, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable; about 25 percent rock fragments by volume; violent effervescence; moderately alkaline.

The depth to carbonates ranges from 14 to 40 inches. Rock fragments make up 0 to 25 percent of the solum and 5 to 50 percent of the C horizon by volume. Generally, the depth to bedrock is more than 60 inches, but it is 40 to 60 inches in some pedons.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The E horizon has hue of 10YR or 7.5YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. The A and E horizons are silt loam or loam. The Bt horizon has hue of 10YR or 7.5YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is silty clay, silty clay loam, or clay. The content of clay in this horizon is as low as 35 percent in some pedons and as high as 60 percent in others. The content of fine sand or coarser sand is less than 15 percent. The C horizon has hue of 2.5Y to 7.5YR, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 6. It is channery silty clay loam, channery clay loam, or channery silt loam.

Tilford Series

The Tilford series consists of deep, well drained soils formed in material weathered from reddish siltstone and silty shale. These soils are on terraces and uplands. Permeability is moderate. Slopes range from 0 to 15 percent.

Typical pedon of Tilford silt loam, 2 to 6 percent slopes, 1,915 feet north and 2,575 feet west of the southeast corner of sec. 20, T. 2 N., R. 7 E.

A—0 to 5 inches; dark brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; neutral; clear wavy boundary.

Bw1—5 to 8 inches; dark brown (7.5YR 4/4) silt loam, dark brown (7.5YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.

Bw2—8 to 11 inches; brown (7.5YR 5/4) silt loam, dark reddish brown (5YR 3/4) moist; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; slight effervescence; neutral; clear wavy boundary.

Bk—11 to 20 inches; reddish yellow (5YR 6/6) silt loam, yellowish red (5YR 4/6) moist; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; few or common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—20 to 60 inches; yellowish red (5YR 5/6) silt loam, red (2.5YR 4/6) moist; massive; slightly hard, very friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to carbonates and the thickness of the mollic epipedon are 7 to 16 inches. Generally, the control section is silt loam, but it is loam or silty clay loam in some pedons. The content of clay in the control section is as low as 18 percent in some pedons and as high as 30 percent in others.

The A horizon has hue of 5YR to 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 2 or 3. Generally, it is silt loam, but it is loam in some pedons. The Bw horizon has hue of 7.5YR to 2.5YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 6. The C horizon has hue of 7.5YR to 2.5YR, value of 5 or 6 (4 or 5 moist), and chroma of 4 to 6. In some pedons it has gypsum crystals.

Trebor Series

The Trebor series consists of moderately deep, well drained soils formed in material weathered from limestone. These soils are on forested mountains. Permeability is moderately slow. Slopes range from 6 to 60 percent.

Typical pedon of Trebor channery silt loam, in an area of Stovho-Trebor complex, 10 to 40 percent slopes, 2,500 feet south and 1,700 feet east of the northwest corner of sec. 28, T. 2 S., R. 3 E.

Oi—1 inch to 0; forest litter.

E—0 to 3 inches; grayish brown (10YR 5/2) channery silt loam, dark brown (10YR 3/3) moist; weak medium platy structure; soft, very friable; about 15 percent rock fragments by volume; slightly acid; abrupt smooth boundary.

Bt1—3 to 10 inches; dark brown (7.5YR 4/4) very channery silty clay loam, dark yellowish brown (10YR 3/4) moist; weak medium prismatic structure parting to strong fine and medium blocky; hard, firm; shiny films on faces of peds; about 35 percent rock fragments by volume; neutral; abrupt wavy boundary.

Bt2—10 to 15 inches; yellowish brown (10YR 5/4) very flaggy silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; hard, firm; patchy films on faces of peds; about 40 percent rock fragments by volume; slight effervescence; neutral; clear wavy boundary.

C—15 to 30 inches; light gray (10YR 7/2) very flaggy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; about 50 percent rock fragments by volume; many fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

R—30 to 60 inches; white (10YR 8/2), hard limestone.

The depth to carbonates ranges from 6 to 14 inches. Rock fragments range in size from channers to flagstones and make up 10 to 25 percent of the surface layer and 35 to 70 percent of the Bt and C horizons by volume. The depth to limestone ranges from 20 to 40 inches.

The E horizon has hue of 7.5YR or 10YR and value of 4 to 7 (3 to 5 moist). Generally, it is channery silt loam, but it is channery loam in some pedons. The Bt horizon has value of 4 to 6 and chroma of 3 or 4. It is very channery, extremely channery, or very flaggy silty clay loam or clay loam. The C horizon is very flaggy or extremely flaggy loam or clay loam.

Vanocker Series

The Vanocker series consists of deep, well drained soils formed in residuum and colluvial sediments weathered from limestone or calcareous sandstone. These soils are on forested mountains. Permeability is moderate. Slopes range from 2 to 60 percent.

Typical pedon of Vanocker channery loam, in an area of Sawdust-Vanocker-Paunsaugunt complex, 10 to 40 percent slopes, 1,300 feet north and 200 feet west of the southeast corner of sec. 34, T. 3 S., R. 2 E.

Oi—1 inch to 0; forest litter.

E—0 to 2 inches; brown (10YR 5/3) channery loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak thin platy; soft, very friable; about 20 percent rock fragments by volume; neutral; abrupt wavy boundary.

Bt—2 to 9 inches; brown (7.5YR 5/4) very channery clay loam, dark brown (7.5YR 4/4) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm; shiny films on faces of peds; about 35 percent rock fragments by volume; neutral; clear wavy boundary.

Bk—9 to 13 inches; pale brown (10YR 6/3) very channery clay loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; about 40 percent rock fragments by volume; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C—13 to 60 inches; very pale brown (10YR 8/3) very channery loam, very pale brown (10YR 7/3) moist; massive; slightly hard, friable; about 40 percent rock fragments by volume in the upper part, increasing to 60 percent in the lower part; violent effervescence; moderately alkaline.

The content of rock fragments is 15 to 40 percent in the A and Bt horizons and 35 to 75 percent in the C horizon. The content of clay in the control section is as low as 25 percent in some pedons and as high as 35 percent in others. Generally, the depth to carbonates is 6 to 10 inches, but it ranges from 4 to 15 inches. The depth to bedrock ranges from 40 to more than 60 inches.

The E horizon has hue of 10YR or 7.5YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is channery loam, channery silt loam, or channery very fine sandy loam. Some pedons have a 1- or 2-inch A horizon, and some have a B/E horizon. The Bt horizon has hue of 2.5YR to 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 3 to 5. It is very channery clay loam or very channery silty clay loam. The Bk horizon has hue of 5YR to 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is very channery loam, very channery clay loam, very channery silty clay loam, or very channery silt loam. The C horizon has hue of 5YR to 10YR, value of 5 to 8 (4 to 7 moist), and chroma of 3 to 6. It is very channery silt loam or flaggy loam.

Virkula Series

The Virkula series consists of deep, well drained soils formed in material weathered from metamorphic rock. These soils are on forested mountains. Permeability is moderately slow. Slopes range from 2 to 35 percent.

Typical pedon of Virkula loam, in an area of Pactola-Virkula-Rock outcrop complex, 10 to 40 percent slopes, 1,400 feet west and 1,320 feet north of the southeast corner of sec. 13, T. 1 S., R. 5 E.

Oi—1 inch to 0; forest litter.

A—0 to 1 inch; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

E—1 to 13 inches; light gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to weak fine and medium granular; soft, very friable; about 5 percent rock fragments by volume; slightly acid; clear wavy boundary.

B/E—13 to 22 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist (B); light gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) moist (E); weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; about 5 percent rock fragments by volume; slightly acid; gradual wavy boundary.

Bt1—22 to 32 inches; light yellowish brown (10YR 6/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; shiny films on faces of peds; about 10 percent rock fragments by volume; medium acid; gradual wavy boundary.

Bt2—32 to 45 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; patchy films on faces of peds; about 10 percent rock fragments by volume; medium acid; gradual wavy boundary.

BC—45 to 55 inches; light yellowish brown (10YR 6/4) channery silty clay loam, yellowish brown (10YR 5/4) moist; weak coarse subangular blocky structure; slightly hard, friable; about 15 percent rock fragments by volume; medium acid; gradual wavy boundary.

C—55 to 60 inches; light yellowish brown (2.5Y 6/4) very channery silty clay loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, friable; about 50 percent rock fragments by volume; medium acid.

The content of rock fragments is 0 to 15 percent in the A and B horizons and 10 to 15 percent in the BC and C horizons by volume. The depth to consolidated bedrock is more than 40 inches.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is loam or silt loam. Some pedons do not have an A horizon. The E horizon has hue of 10YR or 7.5YR, value of 5 to 8 (4 to 7 moist), and chroma of 2 or 3. It is loam, silt loam, or very fine sandy loam. The Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 4. The content of clay in this horizon is as low as 20 percent in some pedons and as high as 34 percent in others. The C horizon has hue of 2.5Y to 7.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 3 to 6. It is channery or very channery clay loam or channery or very channery silty clay loam.

The Virkula soil in the Hilger-Virkula complex, 2 to 30 percent slopes, is a taxadjunct to the series because it has carbonates at a depth of about 21 inches, has cobbles below a depth of 40 inches, and formed in alluvium on terraces. These differences, however, do not alter the use or behavior of the soil.

Winetti Series

The Winetti series consists of deep, somewhat excessively drained soils formed in alluvial material weathered from sedimentary rock. These soils are on flood plains and low terraces along the major creeks. Permeability is moderately rapid. Slopes range from 2 to 10 percent.

Typical pedon of Winetti cobbly loam, 2 to 10 percent slopes, 2,100 feet east and 1,900 feet north of the southwest corner of sec. 8, T. 1 N., R. 7 E.

A—0 to 5 inches; grayish brown (10YR 5/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; about 30 percent cobbles by volume; mildly alkaline; strong effervescence; clear smooth boundary.

C1—5 to 10 inches; brown (7.5YR 5/4) loamy sand, dark brown (7.5YR 4/4) moist; single grain; loose; strong effervescence; moderately alkaline; abrupt smooth boundary.

C2—10 to 30 inches; grayish brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; about 35 percent gravel by volume; strong effervescence; moderately alkaline; clear smooth boundary.

C3—30 to 40 inches; grayish brown (10YR 5/2) very

cobbly sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable; about 45 percent gravel and cobbles by volume; slight effervescence; moderately alkaline; clear wavy boundary.

C4—40 to 60 inches; grayish brown (10YR 5/2) very cobbly sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable; about 55 percent gravel and cobbles by volume; strong effervescence; moderately alkaline.

Rock fragments range in size from gravel to cobbles and make up 35 to 50 percent of the control section by volume. Carbonates are at the surface or within a depth of 4 inches.

The A horizon has hue of 5YR to 10YR, value of 5 or 6 (3 or 4 moist), and chroma of 2 to 4. The C horizon has hue of 5YR to 10YR, value of 5 to 7 (3 or 4 moist), and chroma of 2 to 4. It is stratified loamy sand, gravelly loam, or gravelly, very gravelly, very cobbly, or extremely cobbly sandy loam.

The Winetti soil in the Barnum-Winetti complex, 0 to 6 percent slopes, is a taxadjunct to the series because it formed under mesic temperatures. This difference, however, does not alter the use or behavior of the soil.

Zigweid Series

The Zigweid series consists of deep, well drained soils formed in calcareous, loamy sediments. These soils are on uplands. Permeability is moderate. Slopes range from 2 to 20 percent.

Typical pedon of Zigweid clay loam, in an area of Zigweid-Canyon complex, 2 to 15 percent slopes, 1,200 feet west and 2,300 feet north of the southeast corner of sec. 16, T. 6 S., R. 2 E.

A1—0 to 2 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; slightly hard, friable; mildly alkaline; abrupt smooth boundary.

A2—2 to 4 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

Bw—4 to 12 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk—12 to 20 inches; light gray (2.5Y 7/2) clay loam, grayish brown (2.5Y 5/2) moist; weak coarse subangular blocky structure; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—20 to 60 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; massive; soft, friable; strong effervescence; moderately alkaline.

The depth to carbonates ranges from 0 to 4 inches. Some pedons contain as much as 15 percent rock fragments throughout. Some have soft bedrock at a depth of 40 to 60 inches. The content of clay in the control section is as low as 18 percent in some pedons and as high as 35 percent in others.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 when moist, and chroma of 2 or 3. The Bw horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 3 or 4. The C horizon has hue of 10YR to 5Y.

References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(2) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) Baumberger, Rodney. 1977. South Dakota rangeland resources. Old West Reg. Comm., 150 pp., illus.

(4) Bennett, Daryle L. 1984. Grazing potential of major soils within the Black Hills of South Dakota. South Dakota State Univ., 199 pp., illus.

(5) Darton and Paige. 1925. Central Black Hills folio, South Dakota. U.S. Dep. Inter., Geol. Surv., 34 pp., illus.

(6) Schell, Herbert S. 1975. History of South Dakota. Univ. of Nebraska, Lincoln. 424 pp., illus.

(7) South Dakota Association of Soil and Water Conservation Districts. 1969. History of South Dakota conservation districts. 283 pp., illus.

(8) Thornbury, William D. 1967. Geomorphology of the United States. John Wiley and Sons Inc., 609 pp., illus.

(9) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(10) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(11) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(12) United States Department of Agriculture. 1983. Land and resource management plan, Black Hills National Forest. U.S. Dep. Agric., Forest Serv., 304 pp., illus.

(13) United States Department of Commerce, Bureau of the Census. 1980. Census of population and housing. PHC80-V-43, 22 pp.

Glossary

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cove. A deep recess or a small valley in the side of a mountain.

Cutbanks cave. (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed native range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The thickness of weathered soil material over bedrock. The depth classes recognized in this survey are—

Deep	more than 40 inches
Moderately deep	20 to 40 inches
Shallow	less than 20 inches

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the

soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not

prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard-surfaced roads and streets. These are roads and streets that have an all-weather surface—commonly of asphalt or concrete—and that are expected to carry automobile traffic all year.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species that respond to continued overgrazing, at least initially, by increasing in relation to other plants in the community.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that are not a part of the original plant community that encroach into an

area and grow after the native vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface soil.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, usually of restricted summit area (relative to a plateau), and generally having steep sides (more than 25 percent slope) with or without considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are formed primarily by deep-seated earth movements or volcanic action and secondarily by differential erosion.

Mountain meadow. An area of grassland used primarily for grazing and occurring in mountain valleys surrounded by trees.

Mountain prairie. A large area of grassland that is used primarily for grazing and includes ridges and valleys surrounded by trees. There is no evidence that trees have grown in the major part of the area.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range in moisture content within which the soil remains plastic.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Potential native vegetation. The stabilized plant community on a particular site. The plant cover

reproduces itself and does not change so long as the environment remains the same.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannahs, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Roads, unsurfaced. Low-standard roads built out of the surrounding material. These roads are generally associated with timber management and recreation and are not expected to carry traffic all year.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rolling dips. Earthen structures designed and constructed into roadbeds. These structures are used to divert water from constructed roads. They normally require heavy equipment during construction.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. The slope bounding a drainageway and lying between the drainageway and the adjacent

divide. It is generally linear along the slope width, and overland flow is parallel down the slope.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickspot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes recognized in this survey area are as follows:

Level	0 to 1 percent
Nearly level	0 to 2 percent
Gently undulating	0 to 3 percent
Gently sloping	2 to 6 percent
Moderately sloping	6 to 9 percent
Strongly sloping	9 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 40 percent
Very steep	more than 40 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural

classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The geomorphic component that forms the outermost, gently inclined surface at the base of a hill slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Water bar. A drainage structure used to divert water from trails, unsurfaced roads, and disturbed areas. It is constucted with hard tools or heavy equipment. Soil, rock, brush, or logs can be used when a water bar is constructed.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Custer and Rapid City, South Dakota)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
CUSTER:											
January---	34.4	5.8	20.1	59	-27	8	0.38	0.16	0.57	2	4.6
February--	38.9	10.0	24.5	59	-21	8	.50	.18	.76	2	5.3
March-----	42.3	15.1	28.7	66	-19	28	.87	.44	1.23	3	12.2
April-----	51.5	25.1	38.3	76	0	91	1.86	.86	2.72	6	10.2
May-------	62.0	34.5	48.3	84	18	264	3.24	1.32	4.86	7	.5
June------	72.1	43.1	57.6	92	27	528	3.42	1.84	4.80	8	.0
July------	80.3	48.7	64.5	97	34	760	2.95	1.43	4.26	7	.0
August----	79.0	46.4	62.7	94	31	704	2.05	1.01	2.94	5	.0
September-	69.8	36.8	53.3	91	18	405	1.13	.35	1.75	3	.4
October---	59.4	27.2	43.3	83	9	146	.78	.22	1.22	2	1.0
November--	44.9	16.6	30.8	69	-10	15	.50	.21	.75	2	4.4
December--	38.4	9.6	24.0	63	-22	10	.48	.13	.76	2	6.8
Yearly:											
Average	56.1	26.6	41.3	---	---	---	---	---	---	---	---
Extreme	---	---	---	97	-29	---	---	---	---	---	---
Total--	---	---	---	---	---	2,967	18.16	15.40	20.92	49	45.4
RAPID CITY:											
January---	32.7	9.6	21.2	65	-22	28	0.41	0.14	0.63	1	4.3
February--	37.5	14.7	26.1	70	-14	31	.61	.26	.89	2	7.2
March-----	44.5	21.1	32.8	76	-8	72	.99	.41	1.48	3	8.7
April-----	57.3	32.3	44.8	85	13	199	1.91	.79	2.85	5	6.3
May-------	68.1	43.0	55.6	91	27	484	2.64	1.30	3.80	7	.6
June------	77.9	52.5	65.2	100	36	756	3.22	1.66	4.57	7	.1
July------	86.4	58.7	72.6	105	47	1,011	2.19	1.01	3.20	5	.0
August----	85.6	57.0	71.3	104	43	970	1.45	.67	2.12	4	.0
September-	75.5	46.5	61.0	99	27	630	1.00	.20	1.62	2	.1
October---	63.1	36.0	49.6	89	17	322	.84	.21	1.34	2	1.6
November--	46.9	23.2	35.1	75	-3	61	.50	.21	.74	2	4.7
December--	37.4	14.8	26.1	68	-15	29	.45	.16	.67	2	5.0
Yearly:											
Average	59.4	34.1	46.8	---	---	---	---	---	---	---	---
Extreme	---	---	---	106	-22	---	---	---	---	---	---
Total--	---	---	---	---	---	4,593	16.21	13.25	19.02	42	38.6

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Custer and Rapid City, South Dakota)

Probability	Temperature		
	24^{o} F or lower	28^{o} F or lower	32^{o} F or lower
CUSTER:			
Last freezing temperature in spring:			
1 year in 10 later than--	May 30	June 11	June 26
2 years in 10 later than--	May 24	June 5	June 20
5 years in 10 later than--	May 13	May 26	June 9
First freezing temperature in fall:			
1 year in 10 earlier than--	Sept. 9	Aug. 29	July 28
2 years in 10 earlier than--	Sept. 15	Sept. 3	Aug. 7
5 years in 10 earlier than--	Sept. 25	Sept. 12	Aug. 27
RAPID CITY:			
Last freezing temperature in spring:			
1 year in 10 later than--	May 3	May 14	May 26
2 years in 10 later than--	Apr. 28	May 8	May 19
5 years in 10 later than--	Apr. 19	Apr. 27	May 6
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 7	Sept. 24	Sept. 14
2 years in 10 earlier than--	Oct. 12	Sept. 30	Sept. 19
5 years in 10 earlier than--	Oct. 23	Oct. 10	Sept. 30

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Custer and Rapid City, South Dakota)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
CUSTER:			
9 years in 10	111	86	41
8 years in 10	119	94	54
5 years in 10	135	109	79
2 years in 10	151	123	103
1 year in 10	159	131	116
RAPID CITY:			
9 years in 10	165	147	121
8 years in 10	172	154	129
5 years in 10	186	165	145
2 years in 10	200	177	162
1 year in 10	207	183	170

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Custer County Acres	Pennington County Acres	Total-- Area Acres	Total-- Extent Pct
ApA	Arvada Variant loam, 0 to 2 percent slopes	360	0	360	*
AsA	Arvada-Slickspots complex, 0 to 3 percent slopes	1,890	0	1,890	0.1
BdA	Barnum very fine sandy loam, 0 to 3 percent slopes	2,110	610	2,720	0.2
BeB	Barnum-Winetti complex, 0 to 6 percent slopes	5,140	590	5,730	0.5
BrA	Bullflat silt loam, 0 to 3 percent slopes	1,340	200	1,540	0.1
BrB	Bullflat silt loam, 3 to 6 percent slopes	6,620	550	7,170	0.6
BsB	Bullflat-Cordeston silt loams, 2 to 9 percent slopes	11,930	4,420	16,350	1.4
BtE	Buska-Mocmont-Rock outcrop complex, 10 to 40 percent slopes	25,500	8,280	33,780	2.9
BuE	Buska-Rock outcrop complex, 10 to 40 percent slopes	26,660	17,540	44,200	3.8
BvC	Buska-Virkula loams, 2 to 15 percent slopes	19,070	2,770	21,840	1.9
BwE	Butche-Rock outcrop complex, 9 to 60 percent slopes	11,880	970	12,850	1.1
CcE	Canyon-Bridget complex, 9 to 25 percent slopes	610	1,070	1,680	0.1
CdF	Canyon-Rock outcrop complex, 15 to 60 percent slopes	14,800	6,150	20,950	1.8
CkC	Citadel-Vanocker complex, 2 to 12 percent slopes	3,230	2,500	5,730	0.5
CoA	Colombo loam, channeled, 0 to 4 percent slopes	760	700	1,460	0.1
CpA	Colombo-Urban land complex, 0 to 2 percent slopes	0	790	790	0.1
CvB	Cordeston loam, 2 to 10 percent slopes	3,580	4,610	8,190	0.7
CwB	Cordeston-Marshbrook loams, 0 to 6 percent slopes	4,200	6,510	10,710	0.9
CxC	Cordeston-Winetti complex, 2 to 9 percent slopes	3,870	520	4,390	0.4
DgB	Demar-Grummit-Slickspots complex, 0 to 6 percent slopes	1,200	0	1,200	0.1
GbA	Glenberg fine sandy loam, 0 to 4 percent slopes	370	480	850	0.1
GrD	Grummit-Rock outcrop complex, 6 to 15 percent slopes	2,130	0	2,130	0.2
GrF	Grummit-Rock outcrop complex, 15 to 60 percent slopes	1,790	0	1,790	0.2
GuC	Gurney-Butche complex, 2 to 9 percent slopes	3,530	20	3,550	0.3
GvD	Gypnevee-Rekop-Rock outcrop complex, 6 to 15 percent slopes	14,150	1,460	15,610	1.3
GyD	Gypnevee-Rock outcrop-Urban land complex, 9 to 25 percent slopes	0	1,260	1,260	0.1
HaA	Haverson loam, 0 to 2 percent slopes	1,200	0	1,200	0.1
HeE	Heely channery loam, 9 to 30 percent slopes	2,580	7,990	10,570	0.9
HfC	Heely-Cordeston complex, 6 to 15 percent slopes	3,120	6,370	9,490	0.8
HgB	Hilger cobbly loam, 0 to 6 percent slopes	2,520	2,930	5,450	0.5
HgD	Hilger cobbly loam, 6 to 40 percent slopes	6,930	3,170	10,100	0.9
HmE	Hilger-Metre complex, 10 to 40 percent slopes	4,240	0	4,240	0.4
HnB	Hilger-Urban land complex, 0 to 6 percent slopes	0	320	320	*
HoD	Hilger-Virkula complex, 2 to 30 percent slopes	600	2,715	3,315	0.3
HtG	Hopdraw-Sawdust-Rock outcrop complex, 40 to 80 percent slopes	22,230	10,190	32,420	2.8
JhD	Judy-Heath-Paunsaugunt Variant complex, 2 to 25 percent slopes	0	5,190	5,190	0.4
MhA	Marshbrook loam, 0 to 3 percent slopes	70	750	820	0.1
MnC	Metre-Norrest complex, 2 to 9 percent slopes	6,710	1,190	7,900	0.7
MsC	Mocmont gravelly loam, 2 to 12 percent slopes	1,030	580	1,610	0.1
MtE	Mocmont-Rock outcrop complex, 10 to 40 percent slopes	21,270	0	21,270	1.8
NaC	Nevee channery loam, 6 to 15 percent slopes	1,270	210	1,480	0.1
NbC	Nevee silt loam, 2 to 9 percent slopes	8,470	1,270	9,740	0.8
NcE	Nevee-Gullied land complex, 6 to 40 percent slopes	4,320	0	4,320	0.4
NfE	Nihill-Zigweid complex, 15 to 50 percent slopes	4,330	600	4,930	0.4
NnE	Norrest-Fairburn-Metre complex, 9 to 40 percent slopes	14,300	1,580	15,880	1.4
PaE	Pactola-Virkula-Rock outcrop complex, 10 to 40 percent slopes	11,910	112,780	124,690	10.8
PbD	Paunsaugunt-Gurney complex, 2 to 15 percent slopes	38,120	4,990	43,110	3.7
PcD	Paunsaugunt-Rock outcrop complex, 6 to 30 percent slopes	26,530	2,900	29,430	2.5
PgC	Pierre-Grummit clays, 2 to 9 percent slopes	1,410	0	1,410	0.1
Pt	Pits, quarries	400	1,250	1,650	0.1
ReC	Redbird-Heath silt loams, 2 to 9 percent slopes	480	6,390	6,870	0.6
RfE	Rekop-Gypnevee-Rock outcrop complex, 15 to 40 percent slopes	10,890	1,310	12,200	1.0
RgG	Rock outcrop-Buska complex, 40 to 80 percent slopes	2,580	6,250	8,830	0.8
RhD	Rock outcrop-Butche complex, 2 to 25 percent slopes	4,740	820	5,560	0.5
RkG	Rock outcrop-Mocmont complex, 40 to 80 percent slopes	22,150	8,550	30,700	2.6
RlG	Rock outcrop-Pactola complex, 40 to 80 percent slopes	11,910	67,630	79,540	6.8
RmG	Rock outcrop-Rekop complex, 40 to 80 percent slopes	3,280	0	3,280	0.3

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Custer County	Pennington County	Total-- Area	Extent
		Acres	Acres	Acres	Pct
RnG	Rock outcrop-Sawdust complex, 40 to 80 percent slopes	8,960	2,030	10,990	0.9
RpC	Rockoa-Lakoa complex, 3 to 12 percent slopes	620	0	620	0.1
RrE	Rockoa-Lakoa-Rock outcrop complex, 10 to 40 percent slopes	4,470	310	4,780	0.4
RsF	Rockoa-Rock outcrop complex, 25 to 60 percent slopes	12,550	3,510	16,060	1.4
RtD	Rockoa-Satanta complex, 6 to 30 percent slopes	1,300	1,280	2,580	0.2
SeB	Satanta loam, 2 to 6 percent slopes	2,870	930	3,800	0.3
SfB	Satanta-Arvada complex, 2 to 6 percent slopes	660	180	840	0.1
ShD	Satanta-Canyon loams, 6 to 15 percent slopes	3,380	3,180	6,560	0.6
SpE	Sawdust-Hopdraw-Paunsaugunt complex, 10 to 40 percent slopes	21,650	2,070	23,720	2.0
SrE	Sawdust-Vanocker-Paunsaugunt complex, 10 to 40 percent slopes	75,550	5,950	81,500	7.0
SwE	Shirttail channery loam, 10 to 40 percent slopes	6,670	0	6,670	0.6
SxaE	Spearfish-Nevee silt loams, 9 to 30 percent slopes	1,950	2,050	4,000	0.3
SxbF	Spearfish-Rock outcrop complex, 25 to 60 percent slopes	2,010	50	2,060	0.2
SyaC	Stovho silt loam, 2 to 15 percent slopes	1,160	3,380	4,540	0.4
SybC	Stovho-Lail-Trebor complex, 2 to 12 percent slopes	1,400	35,870	37,270	3.2
SycE	Stovho-Trebor complex, 10 to 40 percent slopes	13,190	73,265	86,455	7.4
TfA	Tilford silt loam, 0 to 2 percent slopes	390	230	620	0.1
TfB	Tilford silt loam, 2 to 6 percent slopes	5,240	1,060	6,300	0.5
TfC	Tilford silt loam, 6 to 15 percent slopes	530	1,420	1,950	0.2
TpC	Tilford-Paunsaugunt complex, 6 to 9 percent slopes	2,960	320	3,280	0.3
TrB	Tilford-Urban land complex, 0 to 9 percent slopes	0	1,220	1,220	0.1
TuG	Trebor-Rock outcrop complex, 40 to 80 percent slopes	810	11,680	12,490	1.1
VcE	Vanocker-Citadel complex, 10 to 40 percent slopes	16,250	18,080	34,330	2.9
VkE	Vanocker-Lakoa complex, 10 to 40 percent slopes	11,790	16,380	28,170	2.4
VnC	Vanocker-Paunsaugunt complex, 2 to 15 percent slopes	4,820	4,290	9,110	0.8
VoG	Vanocker-Sawdust-Rock outcrop complex, 40 to 80 percent slopes	20,560	7,450	28,010	2.4
VpC	Virkula-Pactola complex, 2 to 15 percent slopes	530	7,920	8,450	0.7
WtB	Winetti cobbly loam, 2 to 10 percent slopes	2,450	1,530	3,980	0.3
ZcC	Zigweid-Canyon complex, 2 to 15 percent slopes	3,960	0	3,960	0.3
ZnD	Zigweid-Nihill complex, 6 to 15 percent slopes	3,120	1,330	4,450	0.4
	Water	290	1,750	2,040	0.2
	Total	638,400	528,640	1,167,040	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Only arable soils are listed. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Oats	Alfalfa hay	Cool-season grass
	Bu	Tons	AUM*
Arvada Variant			
Arvada-Slickspots			
BdA----------------------- Barnum	40	1.9	3.0
BrA----------------------- Bullflat	35	1.6	2.7
BrB----------------------- Bullflat	33	1.5	2.5
BsB----------------------- Bullflat-Cordeston	38	1.8	2.8
CvB----------------------- Cordeston	---	1.8	3.0
CwB----------------------- Cordeston-Marshbrook	---	2.0	3.2
GbA----------------------- Glenberg	30	1.7	2.3
HaA----------------------- Haverson	32	1.5	2.5
MnC----------------------- Metre-Norrest	18	1.0	---
NbC----------------------- Nevee	28	1.2	2.0
SeB----------------------- Satanta	32	1.4	2.3
TfA----------------------- Tilford	33	1.5	2.5
TfB----------------------- Tilford	31	1.4	2.3
TfC----------------------- Tilford	28	1.2	2.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--RANGELAND PRODUCTIVITY

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
ApA----------------------- Arvada Variant	Saline Lowland----------------------------	2,000	1,800	1,400
AsA*:				
Arvada------------------	Thin Claypan-----------------------------	840	700	420
Slickspots.				
BdA---------------------- Barnum	Silty----------------------------------	2,800	2,400	1,900
BeB*:				
Barnum------------------	Overflow------------------------------	3,400	3,000	2,500
Winetti-----------------	Overflow------------------------------	3,600	3,200	2,800
BrA, BrB----------------- Bullflat	Silty----------------------------------	3,000	2,500	2,000
BsB*:				
Bullflat----------------	Silty----------------------------------	3,000	2,500	2,000
Cordeston---------------	Overflow------------------------------	4,300	3,600	2,500
CcE*:				
Canyon------------------	Shallow-------------------------------	1,600	1,300	900
Bridget-----------------	Silty----------------------------------	2,500	2,000	1,500
CdF*:				
Canyon------------------	Shallow-------------------------------	1,600	1,300	900
Rock outcrop.				
CoA---------------------- Colombo	Overflow------------------------------	4,300	3,600	2,500
CvB---------------------- Cordeston	Overflow------------------------------	4,300	3,600	2,500
CwB*:				
Cordeston---------------	Overflow------------------------------	4,300	3,600	2,500
Marshbrook--------------	Subirrigated--------------------------	5,400	4,500	3,200
CxC*:				
Cordeston---------------	Overflow------------------------------	4,300	3,600	2,500
Winetti-----------------	Overflow------------------------------	3,600	3,200	2,800
DgB*:				
Demar-------------------	Claypan-------------------------------	1,600	1,400	900
Grummit-----------------	Shallow Clay--------------------------	1,600	1,300	1,000
Slickspots.				

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
GbA: Glenberg	Sandy	3,000	2,500	1,750
GrD*, GrF*:				
Grummit	Shallow Clay	1,600	1,300	1,000
Rock outcrop.				
GuC*:				
Gurney	Silty	2,800	2,300	1,800
Butche	Shallow	1,600	1,300	1,000
GvD*:				
Gypnevee	Thin Upland	2,000	1,700	1,200
Rekop	Shallow	1,700	1,400	1,000
Rock outcrop.				
HaA: Haverson	Loamy Terrace	2,800	2,300	1,600
HeE: Heely	Mountain Prairie	2,500	2,000	1,500
HfC*:				
Heely	Mountain Prairie	2,500	2,000	1,500
Cordeston	Overflow	4,300	3,600	2,500
HgB, HgD: Hilger	Stony Hills	2,800	2,400	2,000
HmE*:				
Hilger	Stony Hills	2,800	2,400	2,000
Metre	Clayey	2,200	1,800	1,300
JhD*:				
Judy	High Country Silty	3,000	2,400	1,900
Heath	High Country Silty	3,200	2,600	2,100
Paunsaugunt Variant	High Country Shallow	1,700	1,400	1,100
MhA: Marshbrook	Subirrigated	5,400	4,500	3,200
MnC*:				
Metre	Clayey	2,200	1,800	1,300
Norrest	Clayey	2,200	1,700	1,200
NaC: Nevee	Thin Upland	1,900	1,600	1,100
NbC: Nevee	Thin Upland	2,000	1,700	1,200

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season: Favorable Lb/acre	Average Lb/acre	Unfavorable Lb/acre
NcE*:				
Nevee	Thin Upland	2,000	1,700	1,200
Gullied land.				
NfE*:				
Nihill	Thin Upland	1,700	1,400	1,000
Zigweid	Thin Upland	1,800	1,500	900
NnE*:				
Norrest	Stony Hills	2,800	2,400	2,000
Fairburn	Stony Hills	2,200	1,800	1,300
Metre	Clayey	2,400	2,000	1,400
PbD*:				
Paunsaugunt	Shallow	1,600	1,300	1,000
Gurney	Silty	2,800	2,300	1,800
PgC*:				
Pierre	Clayey	2,400	2,000	1,400
Grummit	Shallow Clay	1,600	1,300	1,000
ReC*:				
Redbird	High Country Overflow	4,000	3,000	2,000
Heath	High Country Silty	3,200	2,600	2,100
RfE*:				
Rekop	Shallow	1,700	1,400	1,000
Gypnevee	Thin Upland	2,000	1,700	1,200
Rock outcrop.				
RmG*:				
Rock outcrop.				
Rekop	Shallow	1,700	1,400	1,000
RtD*:				
Rockoa.				
Satanta	Silty	2,400	2,000	1,500
SeB Satanta	Silty	2,600	2,300	1,400
SfB*:				
Satanta	Silty	2,400	2,000	1,500
Arvada	Thin Claypan	840	700	420
ShD*:				
Satanta	Silty	2,400	2,000	1,500
Canyon	Shallow	1,600	1,300	900

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
SwE----------------------- Shirttail	Savannah------------------------------	1,800	1,400	1,000
SxaE*:				
Spearfish---------------	Shallow-------------------------------	1,600	1,300	1,000
Nevee--------------------	Thin Upland---------------------------	2,000	1,700	1,200
SxbF*:				
Spearfish---------------	Shallow-------------------------------	1,500	1,200	800
Rock outcrop.				
TfA, TfB, TfC------------ Tilford	Silty---------------------------------	2,800	2,300	1,600
TpC*:				
Tilford------------------	Silty---------------------------------	2,800	2,300	1,600
Paunsaugunt-------------	Shallow-------------------------------	1,600	1,300	1,000
WtB----------------------- Winetti	Overflow------------------------------	3,600	3,200	2,800
ZcC*:				
Zigweid------------------	Thin Upland---------------------------	1,800	1,500	900
Canyon-------------------	Shallow-------------------------------	1,600	1,300	900
ZnD*:				
Zigweid------------------	Thin Upland---------------------------	1,800	1,500	900
Nihill-------------------	Thin Upland---------------------------	1,700	1,400	1,000

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity		
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index*	Volume**
BtE***:									
Buska	4R	Moderate	Moderate	Slight	Moderate	Slight	Ponderosa pine	70	55
							Black Hills spruce	---	---
							Quaking aspen	---	---
							Paper birch	---	---
Mocmont	4R	Moderate	Moderate	Slight	Slight	Slight	Ponderosa pine	65	50
							Quaking aspen	---	---
							Paper birch	---	---
							Oak	---	---
Rock outcrop.									
BuE***:									
Buska	4R	Moderate	Moderate	Slight	Moderate	Slight	Ponderosa pine	70	55
							Black Hills spruce	---	---
							Quaking aspen	---	---
							Paper birch	---	---
Rock outcrop.									
BvC***:									
Buska	4F	Slight	Slight	Slight	Moderate	Slight	Ponderosa pine	70	55
							Black Hills spruce	---	---
							Quaking aspen	---	---
							Paper birch	---	---
Virkula	4A	Slight	Slight	Slight	Slight	Moderate	Ponderosa pine	72	58
							Bur oak	---	---
							Quaking aspen	---	---
							Paper birch	---	---
							Black Hills spruce	---	---
BwE***:									
Butche	2R	Moderate	Moderate	Moderate	Severe	Slight	Ponderosa pine	35	26
							Oak	---	---
Rock outcrop.									
CkC***:									
Citadel	4A	Slight	Slight	Slight	Slight	Moderate	Ponderosa pine	70	55
							Bur oak	---	---
							Quaking aspen	---	---
							Eastern hophornbeam	---	---
							Paper birch	---	---
Vanocker	3F	Slight	Slight	Slight	Slight	Slight	Ponderosa pine	62	48
HoD***:									
Hilger	4R	Moderate	Moderate	Moderate	Slight	Moderate	Ponderosa pine	65	50
							Quaking aspen	---	---

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity		
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index*	Volume**
HoD***:									
Virkula	4R	Moderate	Moderate	Slight	Slight	Moderate	Ponderosa pine	72	58
							Bur oak	---	---
							Quaking aspen	---	---
							Paper birch	---	---
							Black Hills spruce	---	---
HtG***:									
Hopdraw	2R	Severe	Severe	Moderate	Slight	Slight	Ponderosa pine	30	2
							Rocky Mountain juniper	---	---
Sawdust	2R	Severe	Severe	Moderate	Slight	Slight	Ponderosa pine	45	22
Rock outcrop.									
MsC Mocmont	4A	Slight	Slight	Slight	Slight	Slight	Ponderosa pine	65	50
							Quaking aspen	---	---
							Paper birch	---	---
							Oak	---	---
MtE***:									
Mocmont	4R	Moderate	Moderate	Slight	Slight	Slight	Ponderosa pine	65	50
							Quaking aspen	---	---
							Paper birch	---	---
							Oak	---	---
Rock outcrop.									
PaE***:									
Pactola	3R	Moderate	Moderate	Slight	Moderate	Slight	Ponderosa pine	60	46
							Black Hills spruce	---	---
							Quaking aspen	---	---
							Paper birch	---	---
Virkula	4R	Moderate	Moderate	Slight	Slight	Moderate	Ponderosa pine	72	58
							Bur oak	---	---
							Quaking aspen	---	---
							Paper birch	---	---
							Black Hills spruce	---	---
Rock outcrop.									
PcD***:									
Paunsaugunt	2R	Moderate	Moderate	Moderate	Severe	Slight	Ponderosa pine	45	34
Rock outcrop.									
RgG***:									
Rock outcrop.									
Buska	4R	Severe	Severe	Slight	Moderate	Slight	Ponderosa pine	65	50
							Black Hills spruce	---	---
							Quaking aspen	---	---
							Paper birch	---	---
RhD***:									
Rock outcrop.									
Butche	2D	Slight	Slight	Moderate	Severe	Slight	Ponderosa pine	35	26

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index*	Volume**
RkG***:									
Rock outcrop.									
Mocmont-----------	4R	Severe	Severe	Slight	Slight	Slight	Ponderosa pine------	60	46
							Quaking aspen-------	---	---
							Paper birch---------	---	---
							Oak-----------------	---	---
RlG***:									
Rock outcrop.									
Pactola-----------	3R	Severe	Severe	Slight	Moderate	Slight	Ponderosa pine------	55	42
							Black Hills spruce--	---	---
							Quaking aspen-------	---	---
							Paper birch---------	---	---
RnG***:									
Rock outcrop.									
Sawdust-----------	2R	Severe	Severe	Moderate	Slight	Slight	Ponderosa pine------	45	34
RpC***:									
Rockoa------------	3X	Slight	Severe	Moderate	Slight	Slight	Ponderosa pine------	55	42
Lakoa-------------	4A	Slight	Slight	Slight	Slight	Moderate	Ponderosa pine------	65	50
							Bur oak-------------	---	---
							Quaking aspen-------	---	---
							Eastern hophornbeam-	---	---
							Paper birch---------	---	---
RrE***:									
Rockoa------------	3R	Moderate	Severe	Moderate	Slight	Slight	Ponderosa pine------	55	42
Lakoa-------------	4R	Moderate	Moderate	Slight	Slight	Moderate	Ponderosa pine------	65	50
							Bur oak-------------	---	---
							Quaking aspen-------	---	---
							Eastern hophornbeam-	---	---
							Paper birch---------	---	---
Rock outcrop.									
RsF***:									
Rockoa------------	3R	Severe	Severe	Moderate	Slight	Slight	Ponderosa pine------	55	42
Rock outcrop.									
RtD***:									
Rockoa------------	3R	Moderate	Severe	Moderate	Slight	Slight	Ponderosa pine------	55	42
Satanta.									
SpE***:									
Sawdust-----------	3R	Moderate	Moderate	Moderate	Slight	Slight	Ponderosa pine------	50	38
Hopdraw-----------	2R	Moderate	Moderate	Moderate	Slight	Slight	Ponderosa pine------	35	26
							Rocky Mountain juniper -----------	---	---
Paunsaugunt-------	2R	Moderate	Moderate	Moderate	Severe	Slight	Ponderosa pine------	45	34

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity		
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index*	Volume**
SrE***:									
Sawdust	3R	Moderate	Moderate	Moderate	Slight	Slight	Ponderosa pine	50	38
Vanocker	3R	Moderate	Moderate	Slight	Slight	Slight	Ponderosa pine	62	48
Paunsaugunt	2R	Moderate	Moderate	Moderate	Severe	Slight	Ponderosa pine	45	34
SyaC Stovho	4A	Slight	Slight	Slight	Slight	Moderate	Ponderosa pine Black Hills spruce Quaking aspen Paper birch	76 --- --- ---	63 --- --- ---
SybC***:									
Stovho	4A	Slight	Slight	Slight	Slight	Moderate	Ponderosa pine Black Hills spruce Quaking aspen Paper birch	76 --- --- ---	63 --- --- ---
Lail	4A	Slight	Slight	Slight	Slight	Moderate	Ponderosa pine Black Hills spruce Quaking aspen Paper birch	76 --- --- ---	63 --- --- ---
Trebor	3D	Slight	Slight	Slight	Moderate	Moderate	Ponderosa pine Black Hills spruce Quaking aspen Paper birch	60 --- --- ---	46 --- --- ---
SycE***:									
Stovho	4R	Moderate	Moderate	Slight	Slight	Moderate	Ponderosa pine Black Hills spruce Quaking aspen Paper birch	76 --- --- ---	63 --- --- ---
Trebor	3R	Moderate	Moderate	Slight	Moderate	Moderate	Ponderosa pine Black Hills spruce Quaking aspen Paper birch	60 --- --- ---	46 --- --- ---
TuG**:									
Trebor	3R	Severe	Severe	Slight	Moderate	Moderate	Ponderosa pine Black Hills spruce Quaking aspen Paper birch	55 --- --- ---	42 --- --- ---
Rock outcrop.									
VcE***:									
Vanocker	3R	Moderate	Moderate	Slight	Slight	Slight	Ponderosa pine	62	48
Citadel	4R	Moderate	Moderate	Slight	Slight	Moderate	Ponderosa pine Bur oak Quaking aspen Black Hills spruce Paper birch	70 --- --- --- ---	55 --- --- --- ---
VkE***:									
Vanocker	3R	Moderate	Moderate	Slight	Slight	Slight	Ponderosa pine	62	48

See footnotes at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns					Potential productivity		
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Common trees	Site index*	Volume**
VkE***:									
Lakoa	4R	Moderate	Moderate	Slight	Slight	Moderate	Ponderosa pine	70	55
							Bur oak	---	---
							Quaking aspen	---	---
							Black Hills spruce	---	---
							Paper birch	---	---
VnC***:									
Vanocker	3F	Slight	Slight	Slight	Slight	Slight	Ponderosa pine	62	48
Paunsaugunt	2D	Slight	Slight	Moderate	Severe	Slight	Ponderosa pine	45	34
VoG***:									
Vanocker	3R	Severe	Severe	Slight	Slight	Slight	Ponderosa pine	50	44
Sawdust	2R	Severe	Severe	Moderate	Slight	Slight	Ponderosa pine	45	34
Rock outcrop.									
VpC***:									
Virkula	4A	Slight	Slight	Slight	Slight	Moderate	Ponderosa pine	72	58
							Bur oak	---	---
							Quaking aspen	---	---
							Paper birch	---	---
							Black Hills spruce	---	---
Pactola	3F	Slight	Slight	Slight	Moderate	Slight	Ponderosa pine	60	46
							Black Hills spruce	---	---
							Quaking aspen	---	---
							Paper birch	---	---

* Based on site index curves developed by E.M. Hornibrook for the Black Hills of South Dakota and Wyoming. The reference age is 100 years.

** Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

*** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION

(Only the soils that are on slopes of less than 40 percent and support understory vegetation suitable for grazing by livestock are listed)

Grazable woodland group and map symbols	Kind of year	Potential production (dry weight) Canopy 0-25%	26-50%	>50%	Common plant name	Understory composition Canopy 0-25%	26-50%	>50%
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct	Pct
High Woodland: SyaC, SybC, SycE	Favorable	2,200	1,100	600	Bearded wheatgrass	10	5	---
	Normal	1,800	900	500	Oatgrass	10	5	---
	Unfavorable	1,200	600	200	Sedge	20	25	30
					Needlegrass	5	5	---
					Roughleaf ricegrass	5	10	10
					Wildrye	5	3	---
					Brome	5	5	---
					Bluegrass	5	5	10
					Yarrow	3	2	---
					Vetch	2	---	---
					Arrowleaf balsamroot	5	3	---
					Iris	5	2	---
					Bearberry	5	10	15
					Oregongrape	5	5	10
					Snowberry	5	5	10
					Common juniper	5	10	15
Silty Foot Slopes: Citadel part of CkC and VcE; Lakoa part of RpC, RrE, and VkE; Virkula part of BvC, HoD, PaE, and VpC	Favorable	2,200	1,100	500	Prairie dropseed	15	10	---
	Normal	1,800	900	400	Western wheatgrass	10	5	---
	Unfavorable	1,200	600	200	Bearded wheatgrass	5	5	---
					Little bluestem	10	5	---
					Oatgrass	3	5	---
					Needlegrass	10	5	---
					Prairie junegrass	2	5	---
					Bluegrass	5	10	15
					Sedge	5	10	35
					Vetch	5	5	---
					Scurfpea	5	---	---
					Yarrow	5	5	---
					Snowberry	5	5	---
					Leadplant	5	5	10
					Bearberry	5	10	30
					Other shrubs	5	10	10
Rocky Side Slopes: Buska and Mocmont parts of BtE; Buska part of BuE and BvC; Hilger part of HoD; MsC; Mocmont part of MtE; Pactola part of PaE and VpC	Favorable	2,100	1,000	400	Little bluestem	15	10	---
	Normal	1,600	800	300	Prairie dropseed	10	5	---
	Unfavorable	1,100	500	100	Bearded wheatgrass	5	5	---
					Big bluestem	5	---	---
					Sedge	10	20	35
					Roughleaf ricegrass	5	10	20
					Oatgrass	5	3	---
					Bluegrass	5	10	15
					Yarrow	5	2	---
					Cream peavine	5	3	---
					Russet buffaloberry	5	5	---
					Saskatoon serviceberry	5	5	---
					Bearberry	5	15	25
					Chokecherry	5	2	---
					Snowberry	5	2	---
					Leadplant	5	3	5

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Grazable woodland group and map symbols	Potential production (dry weight)				Understory composition			
	Kind of year	Canopy 0-25%	Canopy 26-50%	Canopy >50%	Common plant name	Canopy 0-25%	Canopy 26-50%	Canopy >50%
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct	Pct
Shallow Ridge------------ Butche part of BwE and RhD; Paunsaugunt part of PcD, SpE, SrE, and VnC	Favorable	1,200	600	300	Little bluestem-------	20	15	10
	Normal	1,000	500	200	Needlegrass-----------	5	5	---
	Unfavorable	700	300	100	Sideoats grama--------	10	5	---
					Blue grama------------	5	5	---
					Western wheatgrass----	5	5	---
					Prairie junegrass-----	5	5	---
					Oatgrass--------------	10	5	---
					Bluegrass-------------	5	10	15
					Sedge-----------------	10	15	40
					Fringed sagewort------	5	---	---
					Snowberry-------------	5	10	15
					Chokecherry-----------	5	5	---
					Skunkbush sumac-------	5	10	15
					Mountainmahogany------	5	5	5
Cool Slopes-------------- Rockoa part of RpC, RrE, RsF, and RtD; Vanocker part of CkC, SrE, VcE, VkE, and VnC	Favorable	1,200	600	300	Little bluestem-------	15	10	---
	Normal	900	400	200	Brome-----------------	15	10	---
	Unfavorable	600	300	100	Sedge-----------------	10	20	25
					Russet buffaloberry---	5	5	5
					Common juniper--------	5	10	20
					Bearberry-------------	5	10	20
					Needlegrass-----------	5	2	---
					Western wheatgrass----	5	2	---
					Oatgrass--------------	5	2	---
					Bluegrass-------------	5	10	15
					Bedstraw--------------	5	5	5
					Prairiesmoke----------	5	5	5
					Vetch-----------------	5	2	---
					Snowberry-------------	5	2	---
					Saskatoon serviceberry	5	5	5
Warm Slopes-------------- Sawdust part of SpE and SrE	Favorable	1,000	500	200	Little bluestem-------	25	15	---
	Normal	700	300	150	Big bluestem----------	10	---	---
	Unfavorable	400	200	100	Sideoats grama--------	5	5	---
					Sedge-----------------	10	20	40
					Prairie junegrass-----	5	5	---
					Western wheatgrass----	5	10	---
					Needlegrass-----------	5	5	---
					Bluegrass-------------	5	10	25
					Stiff sunflower-------	3	5	---
					Prairie-clover--------	2	---	---
					Skunkbush sumac-------	5	5	15
					Common juniper--------	5	5	---
					Snowberry-------------	3	5	---
					Rose------------------	2	---	---
					Other perennial forbs-	5	5	5
					Other shrubs----------	5	5	15

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Grazable woodland group and map symbols	Potential production (dry weight)				Understory composition			
	Kind of year	Canopy			Common plant name	Canopy		
		0-25%	26-50%	>50%		0-25%	26-50%	>50%
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct	Pct
Warm Slopes--------------	Favorable	900	400	200	Little bluestem-------	25	15	---
Hopdraw part of SpE	Normal	600	300	150	Western wheatgrass----	5	5	---
	Unfavorable	400	200	100	Sideoats grama--------	5	5	---
					Prairie junegrass-----	5	5	---
					Sand dropseed---------	5	5	---
					Blue grama------------	5	5	---
					Sedge-----------------	10	10	25
					Mountainmahogany------	10	20	35
					Skunkbush sumac-------	5	5	5
					Common juniper--------	5	5	5
					Yucca-----------------	5	---	---
					Snowberry-------------	5	5	---
					Other shrubs----------	5	5	10
					Bluegrass-------------	5	10	20

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Only those map units that are suitable for windbreaks and environmental plantings are listed)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
BdA: Barnum	Lilac, American plum.	---	Ponderosa pine, eastern redcedar, green ash, hackberry, blue spruce, Russian-olive.	Siberian elm, honeylocust.	Eastern cottonwood.
BeB*:					
Barnum	Lilac, American plum.	---	Ponderosa pine, eastern redcedar, green ash, hackberry, blue spruce, Russian-olive.	Siberian elm, honeylocust.	Eastern cottonwood.
Winetti.					
BrA, BrB: Bullflat	---	American plum, Siberian peashrub, lilac, Tatarian honeysuckle, common chokecherry.	Manchurian crabapple, Rocky Mountain juniper, hackberry, green ash, ponderosa pine, Black Hills spruce, blue spruce.	---	---
BsB*:					
Bullflat	---	American plum, Siberian peashrub, lilac, Tatarian honeysuckle, common chokecherry.	Manchurian crabapple, Rocky Mountain juniper, hackberry, green ash, ponderosa pine, Black Hills spruce, blue spruce.	---	---
Cordeston	Lilac, American plum.	Siberian peashrub, Rocky Mountain juniper, Manchurian crabapple, common chokecherry.	Ponderosa pine, green ash, honeylocust, hackberry, Russian-olive.	Siberian elm	---
CoA: Colombo	Lilac, American plum.	Tatarian honeysuckle.	Green ash, hackberry, ponderosa pine, blue spruce, Russian-olive, eastern redcedar.	Siberian elm, honeylocust.	Cottonwood.
CvB: Cordeston	Lilac, American plum.	Siberian peashrub, Rocky Mountain juniper, Manchurian crabapple, common chokecherry.	Ponderosa pine, green ash, honeylocust, hackberry, Russian-olive.	Siberian elm	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
CwB*:					
Cordeston	Lilac, American plum.	Siberian peashrub, Rocky Mountain juniper, Manchurian crabapple, common chokecherry.	Ponderosa pine, green ash, honeylocust, hackberry, Russian-olive.	Siberian elm	---
Marshbrook.					
CxC*:					
Cordeston	Lilac, American plum.	Siberian peashrub, Rocky Mountain juniper, Manchurian crabapple, common chokecherry.	Ponderosa pine, green ash, honeylocust, hackberry, Russian-olive.	Siberian elm	---
Winetti.					
DgB*:					
Demar	Eastern redcedar, Rocky Mountain juniper, lilac, Siberian peashrub, silver buffaloberry.	Siberian elm, green ash, ponderosa pine, Russian-olive.	---	---	---
Grummit.					
Slickspots.					
GbA: Glenberg	Lilac, American plum.	---	Green ash, hackberry, ponderosa pine, blue spruce, Russian-olive, eastern redcedar.	Siberian elm, honeylocust.	Cottonwood.
GuC*:					
Gurney	Lilac, American plum, Siberian peashrub.	Common chokecherry, Manchurian crabapple, Rocky Mountain juniper.	Hackberry, green ash, ponderosa pine, Black Hills spruce, blue spruce.	---	---
Butche.					
HaA: Haverson	Lilac, American plum.	---	Ponderosa pine, green ash, hackberry, Russian-olive, blue spruce, eastern redcedar.	Siberian elm, honeylocust.	Eastern cottonwood.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
HfC*: Heely.					
Cordeston	Lilac, American plum.	Siberian peashrub, Rocky Mountain juniper, Manchurian crabapple, common chokecherry.	Ponderosa pine, green ash, honeylocust, hackberry, Russian-olive.	Siberian elm	---
HmE*: Hilger.					
Metre	Siberian peashrub, American plum, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
MnC*: Metre	Siberian peashrub, American plum, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---
Norrest	Siberian peashrub, lilac, American plum.	Russian-olive, green ash, eastern redcedar, Rocky Mountain juniper, ponderosa pine, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
NnE*: Norrest.					
Fairburn.					
Metre	Siberian peashrub, American plum, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, Manchurian crabapple, eastern redcedar.	Siberian elm, honeylocust.	---	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
PbD*: Paunsaugunt.					
Gurney	Lilac, American plum, Siberian peashrub.	Common chokecherry, Manchurian crabapple, Rocky Mountain juniper.	Hackberry, green ash, ponderosa pine, Black Hills spruce, blue spruce.	---	---
PgC*: Pierre	Siberian peashrub, American plum, lilac.	Ponderosa pine, green ash, Rocky Mountain juniper, Russian-olive, eastern redcedar, Manchurian crabapple.	Siberian elm, honeylocust.	---	---
Grummit.					
RtD*: Rockoa.					
Satanta	Lilac, American plum.	Common chokecherry, Rocky Mountain juniper, Manchurian crabapple, Siberian peashrub.	Honeylocust, ponderosa pine, green ash, hackberry, Russian-olive.	Siberian elm	---
SeB: Satanta	Lilac, American plum.	Common chokecherry, Rocky Mountain juniper, Manchurian crabapple, Siberian peashrub.	Honeylocust, ponderosa pine, green ash, hackberry, Russian-olive.	Siberian elm	---
SfB*: Satanta	Lilac, American plum.	Common chokecherry, Rocky Mountain juniper, Manchurian crabapple, Siberian peashrub.	Honeylocust, ponderosa pine, green ash, hackberry, Russian-olive.	Siberian elm	---
Arvada.					
ShD*: Satanta	Lilac, American plum.	Common chokecherry, Rocky Mountain juniper, Manchurian crab-apple, Siberian peashrub.	Honeylocust, ponderosa pine, green ash, hackberry, Russian-olive.	Siberian elm	---
Canyon.					

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
TfA, TfB, TfC----- Tilford	Lilac, American plum.	Manchurian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub.	Ponderosa pine, hackberry, honeylocust, Russian-olive, green ash.	Siberian elm------	---
TpC*: Tilford----------	Lilac, American plum.	Manchurian crabapple, Rocky Mountain juniper, common chokecherry, Siberian peashrub.	Ponderosa pine, hackberry, honeylocust, Russian-olive, green ash.	Siberian elm------	---
Paunsaugunt.					
ZcC*: Zigweid----------	Lilac, Siberian peashrub, silver buffaloberry, Peking cotoneaster, skunkbush sumac.	Honeylocust, green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm------	---	---
Canyon.					
ZnD*: Zigweid----------	Lilac, Siberian peashrub, silver buffaloberry, Peking cotoneaster, skunkbush sumac.	Honeylocust, green ash, ponderosa pine, Russian-olive, eastern redcedar, Rocky Mountain juniper.	Siberian elm------	---	---
Nihill-----------	Siberian peashrub, lilac, silver buffaloberry, Peking cotoneaster, skunkbush sumac.	Ponderosa pine, Rocky Mountain juniper, Russian-olive, eastern redcedar, green ash, honeylocust.	Siberian elm------	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
ApA: Arvada Variant	Severe: flooding, wetness, excess sodium.	Severe: excess sodium.	Severe: wetness, excess sodium.	Moderate: wetness, dusty.
AsA*:				
Arvada	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Slickspots.				
BdA: Barnum	Severe: flooding.	Moderate: excess salt, dusty.	Moderate: small stones.	Moderate: dusty.
BeB*:				
Barnum	Severe: flooding.	Moderate: excess salt, dusty.	Moderate: small stones.	Moderate: dusty.
Winetti	Severe: flooding.	Moderate: large stones, small stones.	Severe: large stones, small stones.	Moderate: large stones.
BrA: Bullflat	Slight	Slight	Slight	Slight.
BrB: Bullflat	Slight	Slight	Moderate: slope.	Slight.
BsB*:				
Bullflat	Slight	Slight	Moderate: slope.	Slight.
Cordeston	Severe: flooding.	Slight	Moderate: slope, small stones.	Slight.
BtE*:				
Buska	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mocmont	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				
BuE*:				
Buska	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
BvC*:				
Buska	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
BvC*:				
Virkula	Slight	Slight	Moderate: slope, small stones.	Slight.
BwE*:				
Butche	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, small stones, thin layer.	Severe: slope.
Rock outcrop.				
CcE*:				
Canyon	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: thin layer, area reclaim, slope.	Moderate: slope, dusty.
Bridget	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope, dusty.
CdF*:				
Canyon	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: thin layer, area reclaim, slope.	Severe: slope.
Rock outcrop.				
CkC*:				
Citadel	Slight	Slight	Severe: slope.	Slight.
Vanocker	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Slight.
CoA: Colombo	Severe: flooding.	Moderate: dusty.	Moderate: slope, small stones.	Moderate: dusty.
CpA*:				
Colombo	Severe: flooding.	Moderate: dusty.	Moderate: small stones.	Moderate: dusty.
Urban land.				
CvB: Cordeston	Severe: flooding.	Slight	Severe: slope.	Slight.
CwB*:				
Cordeston	Severe: flooding.	Slight	Moderate: slope, small stones.	Slight.
Marshbrook	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
CxC*:				
Cordeston	Severe: flooding.	Slight	Moderate: slope, small stones.	Slight.
Winetti	Severe: flooding.	Moderate: large stones, small stones.	Severe: large stones, small stones.	Moderate: large stones.
DgB*:				
Demar	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight.
Grummit	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Moderate: too clayey.
Slickspots.				
GbA Glenberg	Severe: flooding.	Slight	Moderate: slope, small stones.	Slight.
GrD*:				
Grummit	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Moderate: too clayey.
Rock outcrop.				
GrF*:				
Grummit	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope.
Rock outcrop.				
GuC*:				
Gurney	Slight	Slight	Moderate: slope, thin layer.	Slight.
Butche	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: small stones, thin layer.	Moderate: large stones.
GvD*:				
Gypnevee	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.
Rekop	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: erodes easily.
Rock outcrop.				

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
GyD*:				
Gypnevee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
Rock outcrop.				
Urban land.				
HaA Haverson	Severe: flooding.	Moderate: dusty.	Slight	Moderate: dusty.
HeE Heely	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
HfC*:				
Heely	Moderate: slope.	Moderate: slope.	Severe: slope, small stones.	Slight.
Cordeston	Severe: flooding.	Moderate: slope.	Severe: slope.	Slight.
HgB Hilger	Moderate: large stones, small stones.	Moderate: large stones, small stones.	Severe: large stones, small stones.	Moderate: large stones.
HgD Hilger	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Moderate: large stones, slope.
HmE*:				
Hilger	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.
Metre	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
HnB*:				
Hilger	Moderate: large stones, small stones.	Moderate: large stones, small stones.	Severe: large stones, small stones.	Moderate: large stones.
Urban land.				
HoD*:				
Hilger	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Moderate: large stones, slope.
Virkula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
HtG*:				
Hopdraw	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: large stones, slope.
Sawdust	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				
JhD*:				
Judy	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
Heath	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Paunsaugunt Variant	Severe: small stones, thin layer.	Severe: small stones, thin layer.	Severe: slope, small stones, thin layer.	Slight.
MhA Marshbrook	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.
MnC*:				
Metre	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, thin layer.	Moderate: too clayey.
Norrest	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
MsC Mocmont	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Slight.
MtE*:				
Mocmont	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				
NaC Nevee	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: large stones, dusty.
NbC Nevee	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
NcE*:				
Nevee	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: dusty, slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
NcE*: Gullied land.				
NfE*: Nihill	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Zigweid	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
NnE*: Norrest	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: large stones, slope.
Fairburn	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: large stones, slope, thin layer.	Moderate: slope.
Metre	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Severe: erodes easily.
PaE*: Pactola	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Virkula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
Rock outcrop.				
PbD*: Paunsaugunt	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, small stones, thin layer.	Slight.
Gurney	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
PcD*: Paunsaugunt	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, small stones, thin layer.	Moderate: slope.
Rock outcrop.				
PgC*: Pierre	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, thin layer.	Moderate: too clayey.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
PgC*:				
Grummit	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Moderate: too clayey.
Pt*. Pits				
ReC*:				
Redbird	Severe: flooding.	Slight	Moderate: slope, small stones.	Slight.
Heath	Slight	Slight	Moderate: slope.	Slight.
RfE*:				
Rekop	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, erodes easily.
Gypnevee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
Rock outcrop.				
RgG*:				
Rock outcrop.				
Buska	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
RhD*:				
Rock outcrop.				
Butche	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, small stones, thin layer.	Moderate: large stones.
RkG*:				
Rock outcrop.				
Mocmont	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
RlG*:				
Rock outcrop.				
Pactola	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
RmG*:				
Rock outcrop.				
Rekop	Severe: slope, thin layer, area relcaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, erodes easily.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
RnG*: Rock outcrop.				
Sawdust	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
RpC*: Rockoa	Moderate: large stones.	Moderate: large stones.	Severe: large stones, slope, small stones.	Moderate: large stones.
Lakoa	Slight	Slight	Severe: slope.	Slight.
RrE*: Rockoa	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.
Lakoa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.				
RsF*: Rockoa	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.
Rock outcrop.				
RtD*: Rockoa	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Moderate: large stones, slope.
Satanta	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
SeB Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
SfB*: Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Arvada	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
ShD*: Satanta	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
ShD*:				
Canyon	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim, slope.	Moderate: dusty.
SpE*:				
Sawdust	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Hopdraw	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: large stones, slope.
Paunsaugunt	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, small stones, thin layer.	Severe: slope.
SrE*:				
Sawdust	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Vanocker	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Paunsaugunt	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, small stones, thin layer.	Severe: slope.
SwE Shirttail	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
SxaE*:				
Spearfish	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Moderate: slope, dusty.
Nevee	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: dusty, slope.
SxbF*:				
Spearfish	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope.
Rock outcrop.				
SyaC Stovho	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SybC*:				
Stovho	Slight	Slight	Severe: slope.	Slight.
Lail	Slight	Slight	Severe: slope.	Slight.
Trebor	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
SycE*:				
Stovho	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
Trebor	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
TfA Tilford	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
TfB Tilford	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
TfC Tilford	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
TpC*:				
Tilford	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Paunsaugunt	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, small stones, thin layer.	Slight.
TrB*:				
Tilford	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Urban land.				
TuG*:				
Trebor	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				
VcE*:				
Vanocker	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Citadel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
VkE*:				
Vanocker	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Lakoa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VnC*:				
Vanocker	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
Paunsaugunt	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: slope, small stones, thin layer.	Slight.
VoG*:				
Vanocker	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Sawdust	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Rock outcrop.				
VpC*:				
Virkula	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
Pactola	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
WtB Winetti	Severe: flooding.	Moderate: large stones, small stones.	Severe: large stones, slope, small stones.	Moderate: large stones.
ZcC*:				
Zigweid	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Canyon	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim, slope.	Moderate: dusty.
ZnD*:				
Zigweid	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Nihill	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Native herbaceous plants	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas	Planted trees and shrubs
ApA---------------- Arvada Variant	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Fair	Fair	Very poor.
AsA*:									
Arvada------------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Slickspots.									
BdA---------------- Barnum	Fair	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Good.
BeB*:									
Barnum------------	Poor	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Good.
Winetti-----------	Very poor.	Very poor.	Good	Fair	Very poor.	Fair	Very poor.	Very poor.	Very poor.
BrA, BrB----------- Bullflat	Poor	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Good.
BsB*:									
Bullflat----------	Poor	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Good.
Cordeston---------	Poor	Good	Fair	Poor	Very poor.	Fair	Very poor.	Very poor.	Good.
BtE*:									
Buska-------------	Very poor.	Very poor.	Poor	Poor	Good	Fair	Very poor.	Very poor.	Very poor.
Mocmont-----------	Very poor.	Very poor.	Poor	Poor	Good	Fair	Very poor.	Very poor.	Very poor.
Rock outcrop.									
BuE*:									
Buska-------------	Very poor.	Very poor.	Poor	Poor	Good	Fair	Very poor.	Very poor.	Very poor.
Rock outcrop.									
BvC*:									
Buska-------------	Very poor.	Very poor.	Poor	Poor	Good	Fair	Very poor.	Very poor.	Very poor.
Virkula-----------	Very poor.	Good	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
BwE*:									
Butche------------	Very poor.	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Very poor.
Rock outcrop.									

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas	Planted trees and shrubs
CcE*:									
Canyon	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.
Bridget	Poor	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Good.
CdF*:									
Canyon	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.
Rock outcrop.									
CkC*:									
Citadel	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Vanocker	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
CoA Colombo	Poor	Good	Fair	Fair	Very poor.	Fair	Very poor.	Very poor.	Very poor.
CvB Cordeston	Poor	Good	Fair	Poor	Very poor.	Fair	Very poor.	Very poor.	Good.
CwB*:									
Cordeston	Fair	Good	Fair	Poor	Very poor.	Fair	Very poor.	Very poor.	Good.
Marshbrook	Very poor.	Poor	Fair	Poor	Poor	Fair	Fair	Fair	Good.
CxC*:									
Cordeston	Poor	Good	Good	Poor	Very poor.	Fair	Very poor.	Very poor.	Good.
Winetti	Very poor.	Very poor.	Good	Poor	Fair	Fair	Very poor.	Very poor.	Very poor.
DgB*:									
Demar	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair	Very poor.	Very poor.	Poor.
Grummit	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Slickspots.									
GbA Glenberg	Poor	Fair	Good	Fair	Poor	Fair	Very poor.	Very poor.	Good.
GrD*, GrF*:									
Grummit	Very poor.	Very poor.	Fair	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor.
Rock outcrop.									

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Native herbaceous plants	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas	Planted trees and shrubs
GuC*:									
Gurney	Poor	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
Butche	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair	Very poor.	Very poor.	Very poor.
GvD*:									
Gypnevee	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rekop	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.									
HaA Haverson	Fair	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Good.
HeE Heely	Very poor.	Very poor.	Good	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
HfC*:									
Heely	Very poor.	Very poor.	Good	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Cordeston	Poor	Good	Fair	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good.
HgB, HgD Hilger	Very poor.	Very poor.	Fair	Poor	Poor	Fair	Very poor.	Very poor.	Very poor.
HmE*:									
Hilger	Very poor.	Very poor.	Good	Poor	Very poor.	Good	Very poor.	Very poor.	Very poor.
Metre	Very poor.	Very poor.	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
HoD*:									
Hilger	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Virkula	Very poor.	Very poor.	Poor	Poor	Good	Fair	Very poor.	Very poor.	Very poor.
HtG*:									
Hopdraw	Very poor.	Very poor.	Poor	Very poor.	Fair	Good	Very poor.	Very poor.	Very poor.
Sawdust	Very poor.	Very poor.	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Very poor.
Rock outcrop.									

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Native herbaceous plants	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas	Planted trees and shrubs
JhD*:									
Judy	Very poor.	Very poor.	Good	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Heath	Very poor.	Very poor.	Good	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Paunsaugunt Variant	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
MhA: Marshbrook	Very poor.	Poor	Fair	Poor	Poor	Fair	Fair	Fair	Good.
MnC*:									
Metre	Poor	Fair	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
Norrest	Poor	Good	Good	Very poor	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
MsC: Mocmont	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
MtE*:									
Mocmont	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Rock outcrop.									
NaC: Nevee	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
NbC: Nevee	Poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
NcE*:									
Nevee	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Gullied land.									
NfE*:									
Nihill	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Zigweid	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
NnE*:									
Norrest	Very poor.	Very poor.	Good	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Fairburn	Very poor.	Very poor.	Good	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Metre	Very poor.	Very poor.	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas	Planted trees and shrubs
PaE*:									
Pactola	Very poor.	Very poor.	Very poor.	Poor	Good	Fair	Very poor.	Very poor.	Very poor.
Virkula	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Rock outcrop.									
PbD*:									
Paunsaugunt	Very poor.	Very poor.	Fair	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.
Gurney	Poor	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
PcD*:									
Paunsaugunt	Very poor.	Very poor.	Poor	Very poor.	Poor	Fair	Very poor.	Very poor.	Very poor.
Rock outcrop.									
PgC*:									
Pierre	Poor	Fair	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
Grummit	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.
Pt*. Pits									
ReC*:									
Redbird	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Heath	Very poor.	Very poor.	Good	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
RfE*:									
Rekop	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Gypnevee	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.									
RgG*:									
Rock outcrop.									
Buska	Very poor.	Very poor.	Poor	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.
RhD*:									
Rock outcrop.									

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Native herbaceous plants	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas	Planted trees and shrubs
RhD*:									
Butche	Very poor.	Very poor.	Poor	Poor	Poor	Fair	Very poor.	Very poor.	Very poor.
RkG*:									
Rock outcrop.									
Mocmont	Very poor.	Very poor.	Poor	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.
RlG*:									
Rock outcrop.									
Pactola	Very poor.	Very poor.	Poor	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.
RmG*:									
Rock outcrop.									
Rekop	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
RnG*:									
Rock outcrop.									
Sawdust	Very poor.	Very poor.	Poor	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor.
RpC*:									
Rockoa	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Lakoa	Very poor.	Very poor.	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Very poor.
RrE*:									
Rockoa	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Lakoa	Very poor.	Very poor.	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Very poor.
Rock outcrop.									
RsF*:									
Rockoa	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Rock outcrop.									
RtD*:									
Rockoa	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Satanta	Poor	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.	Good.
SeB Satanta	Fair	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Native herbaceous plants	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas	Planted trees and shrubs
SfB*:									
Satanta	Fair	Good	Good	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good.
Arvada	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.
ShD*:									
Satanta	Poor	Good	Good	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Good.
Canyon	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.
SpE*:									
Sawdust	Very poor.	Very poor.	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Very poor.
Hopdraw	Very poor.	Very poor.	Poor	Very poor.	Fair	Good	Very poor.	Very poor.	Very poor.
Paunsaugunt	Very poor.	Very poor.	Poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.
SrE*:									
Sawdust	Very poor.	Very poor.	Poor	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.
Vanocker	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Paunsaugunt	Very poor.	Very poor.	Poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.
SwE Shirttail	Very poor.	Very poor.	Fair	Very poor.	Fair	Fair	Very poor.	Very poor.	Very poor.
SxaE*:									
Spearfish	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Nevee	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
SxbF*:									
Spearfish	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.									
SyaC Stovho	Very poor.	Very poor.	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Very poor.
SybC*:									
Stovho	Very poor.	Very poor.	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Very poor.
Lail	Very poor.	Very poor.	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Native herbaceous plants	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas	Planted trees and shrubs
SybC*:									
Trebor	Very poor.	Very poor.	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Very poor.
SycE*:									
Stovho	Very poor.	Very poor.	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Very poor.
Trebor	Very poor.	Very poor.	Poor	Very poor.	Good	Good	Very poor.	Very poor.	Very poor.
TfA, TfB Tilford	Fair	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Good.
TfC Tilford	Poor	Good	Good	Poor	Very poor.	Very poor	Very poor.	Very poor.	Good.
TpC*:									
Tilford	Poor	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Good.
Paunsaugunt	Very poor.	Very poor.	Fair	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.
TuG*:									
Trebor	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Very poor.
Rock outcrop.									
VcE*:									
Vanocker	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Citadel	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
VkE*:									
Vanocker	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Lakoa	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
VnC*:									
Vanocker	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Paunsaugunt	Very poor.	Very poor.	Poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.
VoG*:									
Vanocker	Very poor.	Very poor.	Poor	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.
Sawdust	Very poor.	Very poor.	Poor	Very poor.	Good	Fair	Very poor.	Very poor.	Very poor.
Rock outcrop.									

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas	Planted trees and shrubs
VpC*:									
Virkula	Very poor.	Good	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
Pactola	Very poor.	Very poor.	Poor	Poor	Good	Good	Very poor.	Very poor.	Very poor.
WtB Winetti	Very poor.	Very poor.	Good	Fair	Poor	Fair	Very poor.	Very poor.	Very poor.
ZcC*:									
Zigweid	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Canyon	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.
ZnD*:									
Zigweid	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.
Nihill	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Hard-surfaced roads and streets
ApA: Arvada Variant	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.
AsA*:					
Arvada	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Slickspots.					
BdA: Barnum	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: shrink-swell, low strength, flooding.
BeB*:					
Barnum	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: shrink-swell, low strength, flooding.
Winetti	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
BrA: Bullflat	Slight	Slight	Slight	Moderate: large stones.	Moderate: low strength, frost action.
BrB: Bullflat	Slight	Slight	Slight	Moderate: slope, large stones.	Moderate: low strength, frost action.
BsB*:					
Bullflat	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.
Cordeston	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, shrink-swell.
BtE*:					
Buska	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mocmont	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
BuE*:					
Buska	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Hard-surfaced roads and streets
BuE*:					
Rock outcrop.					
BvC*:					
Buska	Moderate: large stones, slope.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, frost action, large stones.
Virkula	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
BwE*:					
Butche	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
Rock outcrop.					
CcE*:					
Canyon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bridget	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CdF*:					
Canyon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
CkC*:					
Citadel	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Vanocker	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action.
CoA Colombo	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
CpA*:					
Colombo	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
Urban land.					
CvB Cordeston	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, shrink-swell.
CwB*:					
Cordeston	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, shrink-swell.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Hard-surfaced roads and streets
CwB*:					
Marshbrook	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.
CxC*:					
Cordeston	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, shrink-swell.
Winetti	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
DgB*:					
Demar	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Grummit	Slight	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Slickspots.					
GbA: Glenberg	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
GrD*:					
Grummit	Moderate: slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Rock outcrop.					
GrF*:					
Grummit	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
Rock outcrop.					
GuC*:					
Gurney	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: low strength.
Butche	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
GvD*:					
Gypnevee	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Rekop	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Rock outcrop.					

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Hard-surfaced roads and streets
GyD*:					
Gypnevee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
Urban land.					
HaA Haverson	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
HeE Heely	Severe: depth to rock, large stones, slope.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
HfC*:					
Heely	Severe: depth to rock, large stones.	Severe: large stones.	Severe: depth to rock, large stones.	Severe: slope, large stones.	Severe: large stones.
Cordeston	Moderate: slope.	Severe: flooding.	Severe: flooding.	Severe: flooding, slope.	Moderate: slope, flooding, shrink-swell.
HgB Hilger	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
HgD Hilger	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
HmE*:					
Hilger	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Metre	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
HnB*:					
Hilger	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
Urban land.					
HoD*:					
Hilger	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Virkula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Hard-surfaced roads and streets
HtG*:					
Hopdraw	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Sawdust	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Rock outcrop.					
JhD*:					
Judy	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Heath	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Paunsaugunt Variant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
MhA Marshbrook	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.
MnC*:					
Metre	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Norrest	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
MsC Mocmont	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, frost action.
MtE*:					
Mocmont	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
NaC Nevee	Moderate: large stones, slope.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: low strength, slope, large stones.
NbC Nevee	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
NcE*:					
Nevee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Hard-surfaced roads and streets
NcE*: Gullied land.					
NfE*: Nihill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Zigweid	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
NnE*: Norrest	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
Fairburn	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Metre	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
PaE*: Pactola	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Virkula	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Rock outcrop.					
PbD*: Paunsaugunt	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
Gurney	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.
PcD*: Paunsaugunt	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
Rock outcrop.					
PgC*: Pierre	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Grummit	Slight	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Hard-surfaced roads and streets
Pt*. Pits					
ReC*:					
Redbird	Severe: large stones.	Severe: flooding, large stones.	Severe: flooding, large stones.	Severe: flooding, large stones.	Severe: large stones.
Heath	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
RfE*:					
Rekop	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gypnevee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
RgG*:					
Rock outcrop.					
Buska	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
RhD*:					
Rock outcrop.					
Butche	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
RkG*:					
Rock outcrop.					
Mocmont	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
RlG*:					
Rock outcrop.					
Pactola	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
RmG*:					
Rock outcrop.					
Rekop	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
RnG*:					
Rock outcrop.					
Sawdust	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Hard-surfaced roads and streets
RpC*:					
Rockoa	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
Lakoa	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
RrE*:					
Rockoa	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Lakoa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Rock outcrop.					
RsF*:					
Rockoa	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Rock outcrop.					
RtD*:					
Rockoa	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
SeB Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
SfB*:					
Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
Arvada	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
ShD*:					
Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.
Canyon	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
SpE*:					
Sawdust	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Hopdraw	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Hard-surfaced roads and streets
SpE*:					
Paunsaugunt------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
SrE*:					
Sawdust----------	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Vanocker---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Paunsaugunt------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.
SwE--------------- Shirttail	Severe: cutbanks cave, large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
SxaE*:					
Spearfish--------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Nevee------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SxbF*:					
Spearfish--------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
SyaC-------------- Stovho	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
SybC*:					
Stovho-----------	Slight-----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Lail-------------	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Trebor-----------	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, shrink-swell.
SycE*:					
Stovho-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Trebor-----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Hard-surfaced roads and streets
TfA: Tilford	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.
TfB: Tilford	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.
TfC: Tilford	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope, frost action.
TpC*:					
Tilford	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.
Paunsaugunt	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
TrB*:					
Tilford	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.
Urban land.					
TuG*:					
Trebor	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
VcE*:					
Vanocker	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Citadel	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.
VkE*:					
Vanocker	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lakoa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
VnC*:					
Vanocker	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, slope, frost action.
Paunsaugunt	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Hard-surfaced roads and streets
VoG*:					
Vanocker----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sawdust----------	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Rock outcrop.					
VpC*:					
Virkula----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Pactola----------	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.
WtB--------------- Winetti	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
ZcC*:					
Zigweid----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.
Canyon-----------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
ZnD*:					
Zigweid----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.
Nihill-----------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ApA: Arvada Variant	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
AsA*:					
Arvada	Severe: percs slowly.	Slight	Slight	Slight	Good.
Slickspots.					
BdA: Barnum	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
BeB*:					
Barnum	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
Winetti	Moderate: flooding.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
BrA: Bullflat	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey, large stones.	Slight	Fair: too clayey.
BrB: Bullflat	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey, large stones.	Slight	Fair: too clayey.
BsB*:					
Bullflat	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey, large stones.	Slight	Fair: too clayey.
Cordeston	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
BtE*:					
Buska	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: large stones, slope.
Mocmont	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					
BuE*:					
Buska	Severe: slope.	Severe: slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: large stones, slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BuE*: Rock outcrop.					
BvC*: Buska	Moderate: thin layer, seepage, slope.	Severe: slope.	Severe: depth to rock, seepage.	Moderate: seepage, slope.	Poor: large stones.
Virkula	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: small stones.
BwE*: Butche	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
Rock outcrop.					
CcE*: Canyon	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, small stones, slope.
Bridget	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
CdF*: Canyon	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, small stones, slope.
Rock outcrop.					
CkC*: Citadel	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Vanocker	Moderate: percs slowly.	Severe: slope.	Moderate: large stones.	Slight	Poor: small stones.
CoA Colombo	Moderate: flooding, percs slowly.	Moderate: seepage, slope.	Severe: too sandy.	Moderate: flooding.	Poor: too sandy.
CpA*: Colombo	Moderate: flooding, percs slowly.	Moderate: seepage.	Severe: too sandy.	Moderate: flooding.	Poor: too sandy.
Urban land.					
CvB Cordeston	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CwB*:					
Cordeston	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
Marshbrook	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: small stones, wetness.
CxC*:					
Cordeston	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
Winetti	Moderate: flooding.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
DgB*:					
Demar	Severe: percs slowly.	Moderate: slope.	Severe: too acid.	Slight	Poor: hard to pack, too acid.
Grummit	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, hard to pack.
Slickspots.					
GbA Glenberg	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding.	Severe: flooding.	Fair: too sandy.
GrD*:					
Grummit	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, hard to pack.
Rock outcrop.					
GrF*:					
Grummit	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
Rock outcrop.					
GuC*:					
Gurney	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, large stones.
Butche	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Slight	Poor: area reclaim, thin layer.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
GvD*:					
Gypnevee	Moderate: thin layer, seepage, slope.	Severe: slope.	Severe: seepage.	Moderate: slope.	Fair: area reclaim, slope, thin layer.
Rekop	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, small stones, thin layer.
Rock outcrop.					
GyD*:					
Gypnevee	Severe: slope.	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Poor: slope.
Rock outcrop.					
Urban land.					
HaA Haverson	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
HeF Heely	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, slope, seepage.	Severe: slope.	Poor: area reclaim, large stones, slope.
HfC*:					
Heely	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Moderate: seepage, slope.	Poor: area reclaim, large stones.
Cordeston	Moderate: flooding, percs slowly, slope.	Severe: flooding, slope.	Moderate: flooding, slope.	Moderate: flooding, slope.	Fair: slope.
HgB Hilger	Severe: large stones.	Severe: large stones.	Severe: large stones.	Slight	Poor: large stones.
HgD Hilger	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
HmE*:					
Hilger	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Metre	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage, too clayey.	Moderate: slope.	Poor: area reclaim, too clayey, hard to pack.
HnB*:					
Hilger	Severe: large stones.	Severe: large stones.	Severe: large stones.	Slight	Poor: large stones.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HnB*: Urban land.					
HoD*: Hilger	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Virkula	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
HtG*: Hopdraw	Severe: poor filter, slope, large stones.	Severe: seepage, slope, large stones.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: too sandy, small stones, slope.
Sawdust	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Rock outcrop.					
JhD*: Judy	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, too clayey.	Moderate: slope.	Poor: area reclaim, too clayey, hard to pack.
Heath	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Paunsaugunt Variant	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, small stones.
MhA: Marshbrook	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: small stones, wetness.
MnC*: Metre	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage, too clayey.	Slight	Poor: area reclaim, too clayey, hard to pack.
Norrest	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, hard to pack.
MsC: Mocmont	Moderate: percs slowly.	Severe: seepage, slope.	Severe: seepage.	Slight	Poor: small stones.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
MtE*:					
Mocmont	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					
NaC: Nevee	Moderate: percs slowly, slope, large stones.	Severe: slope, large stones.	Severe: large stones.	Moderate: slope.	Fair: large stones, slope.
NbC: Nevee	Slight	Moderate: slope, seepage.	Slight	Slight	Good.
NcE*:					
Nevee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Gullied land.					
NfE*:					
Nihill	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Zigweid	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
NnE*:					
Norrest	Severe: thin layer, seepage, slope.	Severe: seepage, large stones, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
Fairburn	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
Metre	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage, too clayey.	Moderate: slope.	Poor: area reclaim, too clayey, hard to pack.
PaE*:					
Pactola	Severe: slope, large stones.	Severe: slope, large stones.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: large stones, slope.
Virkula	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PbD*:					
Paunsaugunt	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock.	Severe: seepage, depth to rock.	Poor: area reclaim, small stones, thin layer.
Gurney	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Moderate: seepage, slope.	Poor: area reclaim, large stones.
PcD*:					
Paunsaugunt	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, small stones, slope.
Rock outcrop.					
PgC*:					
Pierre	Severe: thin layer, seepage, percs slowly.	Severe: seepage.	Severe: seepage, too clayey.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
Grummit	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, hard to pack.
Pt*. Pits					
ReC*:					
Redbird	Severe: large stones.	Severe: large stones.	Severe: large stones.	Moderate: flooding.	Poor: large stones.
Heath	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
RfE*:					
Rekop	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, small stones, slope.
Gypnevee	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Rock outcrop.					
RgG*: Rock outcrop.					
Buska	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: large stones, slope.
RhD*: Rock outcrop.					

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RhD*:					
Butche	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Moderate: slope.	Poor: area reclaim, thin layer.
RkG*:					
Rock outcrop.					
Mocmont	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: small stones, slope.
RlG*:					
Rock outcrop.					
Pactola	Severe: slope, large stones.	Severe: slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope.	Poor: large stones, slope.
RmG*:					
Rock outcrop.					
Rekop	Severe: thin layer, seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, small stones, slope.
RnG*:					
Rock outcrop.					
Sawdust	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
RpC*:					
Rockoa	Severe: large stones.	Severe: seepage, slope, large stones.	Severe: seepage, large stones.	Severe: seepage.	Poor: large stones.
Lakoa	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Poor: small stones.
RrE*:					
Rockoa	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
Lakoa	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Rock outcrop.					

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
RsF*:					
Rockoa	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
Rock outcrop.					
RtD*:					
Rockoa	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope, large stones.	Severe: seepage, slope.	Poor: large stones, slope.
Satanta	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
SeB Satanta	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
SfB*:					
Satanta	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Arvada	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.
ShD*:					
Satanta	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Canyon	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, small stones.
SpE*:					
Sawdust	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Hopdraw	Severe: poor filter, slope, large stones.	Severe: seepage, slope, large stones.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: too sandy, small stones, slope.
Paunsaugunt	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, small stones, slope.
SrE*:					
Sawdust	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Vanocker	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SrE*:					
Paunsaugunt	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, small stones, slope.
SwE Shirttail	Severe: slope, large stones.	Severe: slope, large stones.	Severe: depth to rock, slope, seepage.	Severe: slope.	Poor: large stones, slope.
SxaE*:					
Spearfish	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
Nevee	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
SxbF*:					
Spearfish	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
Rock outcrop.					
SyaC Stovho	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey, large stones.	Moderate: slope.	Poor: large stones.
SybC*:					
Stovho	Severe: percs slowly.	Severe: slope.	Moderate: too clayey, large stones.	Slight	Poor: large stones.
Lail	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Trebor	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: slope.	Poor: area reclaim, large stones.
SycE*:					
Stovho	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: large stones, slope.
Trebor	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, large stones, slope.
TfA Tilford	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
TfB------------------ Tilford	Slight------------	Moderate: seepage, slope.	Moderate: too clayey.	Slight------------	Fair: too clayey.
TfC------------------ Tilford	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
TpC*:					
Tilford------------	Slight------------	Severe: slope.	Moderate: too clayey.	Slight------------	Fair: too clayey.
Paunsaugunt--------	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, small stones.
TrB*:					
Tilford------------	Slight------------	Moderate: seepage, slope.	Moderate: too clayey.	Slight------------	Fair: too clayey.
Urban land.					
TuG*:					
Trebor-------------	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, large stones, slope.
Rock outcrop.					
VcE*:					
Vanocker-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Citadel------------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
VkE*:					
Vanocker-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Lakoa--------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
VnC*:					
Vanocker-----------	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, large stones.	Moderate: slope.	Poor: small stones.
Paunsaugunt--------	Severe: thin layer, seepage.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, small stones.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
VoG*:					
Vanocker	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Sawdust	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: large stones, slope.
Rock outcrop.					
VpC*:					
Virkula	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: small stones.
Pactola	Severe: large stones.	Severe: slope, large stones.	Severe: depth to rock, seepage, large stones.	Moderate: slope.	Poor: large stones.
WtB Winetti	Moderate: flooding.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage, small stones.
ZcC*:					
Zigweid	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Canyon	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, small stones.
ZnD*:					
Zigweid	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Nihill	Moderate: slope.	Severe: seepage, slope.	Moderate: slope.	Moderate: slope.	Poor: small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
ApA: Arvada Variant	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
AsA*:				
Arvada	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess sodium.
Slickspots.				
BdA: Barnum	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, excess salt.
BeB*:				
Barnum	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, excess salt.
Winetti	Good	Probable	Probable	Poor: small stones, area reclaim.
BrA, BrB: Bullflat	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
BsB*:				
Bullflat	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Cordeston	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
BtE*:				
Buska	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Mocmont	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BuE*:				
Buska----------------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
BvC*:				
Buska----------------	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Virkula--------------	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
BwE*:				
Butche---------------	Poor: area reclaim, slope, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, thin layer.
Rock outcrop.				
CcE*:				
Canyon---------------	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.
Bridget--------------	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
CdF*:				
Canyon---------------	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.
Rock outcrop.				
CkC*:				
Citadel--------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, large stones, area reclaim.
Vanocker-------------	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
CoA------------------ Colombo	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
CpA*:				
Colombo--------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CpA*: Urban land.				
CvB Cordeston	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
CwB*: Cordeston	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Marshbrook	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
CxC*: Cordeston	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Winetti	Good	Probable	Probable	Poor: small stones, area reclaim.
DgB*: Demar	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, too acid.
Grummit	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
Slickspots.				
GbA Glenberg	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
GrD*, GrF*: Grummit	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
Rock outcrop.				
GuC*: Gurney	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Butche	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, thin layer.
GvD*: Gypnevee	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
GvD*:				
Rekop	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Rock outcrop.				
GyD*:				
Gypnevee	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Rock outcrop.				
Urban land.				
HaA Haverson	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
HeE Heely	Poor: area reclaim, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, slope.
HfC*:				
Heely	Poor: area reclaim, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones.
Cordeston	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
HgB Hilger	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim.
HgD Hilger	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
HmE*:				
Hilger	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Metre	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
HnB*:				
Hilger	Poor:	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim.
Urban land.				

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HoD*:				
Hilger	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Virkula	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
HtG*:				
Hopdraw	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: too sandy, small stones, area reclaim.
Sawdust	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
Rock outcrop.				
JhD*:				
Judy	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
Heath	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Paunsaugunt Variant	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.
MhA Marshbrook	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
MnC*:				
Metre	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Norrest	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MsC Mocmont	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
MtE*:				
Mocmont	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MtE*:				
Rock outcrop.				
NaC Nevee	Fair: low strength, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim.
NbC Nevee	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
NcE*:				
Nevee	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Gullied land.				
NfE*:				
Nihill	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Zigweid	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
NnE*:				
Norrest	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
Fairburn	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, area reclaim, slope.
Metre	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
PaE*:				
Pactola	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Virkula	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Rock outcrop.				
PbD*:				
Paunsaugunt	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
PbD*:				
Gurney	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
PcD*:				
Paunsaugunt	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
PgC*:				
Pierre	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Grummit	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
Pt*. Pits				
ReC*:				
Redbird	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim.
Heath	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
RfE*:				
Rekop	Poor: area reclaim, slope, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Gypnevee	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Rock outcrop.				
RgG*: Rock outcrop.				
Buska	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
RhD*: Rock outcrop.				

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RhD*:				
Butche	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, thin layer.
RkG*:				
Rock outcrop.				
Mocmont	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
RlG*:				
Rock outcrop.				
Pactola	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
RmG*:				
Rock outcrop.				
Rekop	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
RnG*:				
Rock outcrop.				
Sawdust	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
RpC*:				
Rockoa	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim.
Lakoa	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
RrE*:				
Rockoa	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Lakoa	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Rock outcrop.				

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RsF*:				
Rockoa	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Rock outcrop.				
RtD*:				
Rockoa	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
SeB Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
SfB*:				
Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Arvada	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess sodium.
ShD*:				
Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Canyon	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.
SpE*:				
Sawdust	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
Hopdraw	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: too sandy, small stones, area reclaim.
Paunsaugunt	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
SrE*:				
Sawdust	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SrE*:				
Vanocker	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Paunsaugunt	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
SwE Shirttail	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
SxaE*:				
Spearfish	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer, slope.
Nevee	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
SxbF*:				
Spearfish	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer, slope.
Rock outcrop.				
SyaC Stovho	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
SybC*:				
Stovho	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Lail	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Trebor	Poor: area reclaim.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones.
SycE*:				
Stovho	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Trebor	Poor: area reclaim, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
TfA, TfB: Tilford	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
TfC: Tilford	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
TpC*:				
Tilford	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Paunsaugunt	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
TrB*:				
Tilford	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Urban land.				
TuG*:				
Trebor	Poor: area reclaim, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, slope.
Rock outcrop.				
VcE*:				
Vanocker	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Citadel	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, large stones, area reclaim.
VkE*:				
Vanocker	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Lakoa	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
VnC*:				
Vanocker	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Paunsaugunt	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
VoG*:				
Vanocker	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Sawdust	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, slope.
Rock outcrop.				
VpC*:				
Virkula	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Pactola	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim.
WtB Winetti	Good	Probable	Probable	Poor: small stones, area reclaim.
ZcC*:				
Zigweid	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Canyon	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.
ZnD*:				
Zigweid	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Nihill	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
ApA: Arvada Variant	Slight	Severe: wetness, excess sodium.	Percs slowly, frost action, excess salt.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, percs slowly, excess sodium.
AsA*:						
Arvada	Slight	Severe: excess sodium.	Deep to water	Droughty, soil blowing.	Soil blowing, percs slowly.	Percs slowly, excess sodium.
Slickspots.						
BdA: Barnum	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
BeB*:						
Barnum	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
Winetti	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Favorable	Droughty.
BrA: Bullflat	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
BrB: Bullflat	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
BsB*:						
Bullflat	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Cordeston	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
BtE*:						
Buska	Severe: slope.	Severe: piping.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Mocmont	Severe: seepage, slope.	Moderate: thin layer, large stones.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.
Rock outcrop.						
BuE*:						
Buska	Severe: slope.	Severe: piping.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Rock outcrop.						

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
BvC*:						
Buska	Severe: slope.	Severe: piping.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Virkula	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
BwE*:						
Butche	Severe: depth to rock, seepage, slope.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Rock outcrop.						
CcE*:						
Canyon	Severe: seepage, slope.	Severe: piping, thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Bridget	Severe: slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
CdF*:						
Canyon	Severe: seepage, slope.	Severe: piping, thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Rock outcrop.						
CkC*:						
Citadel	Moderate: seepage, slope.	Moderate: thin layer, hard to pack, large stones.	Deep to water	Slope, percs slowly, rooting depth.	Large stones, erodes easily.	Large stones, erodes easily.
Vanocker	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, droughty.	Large stones	Large stones, droughty.
CoA Colombo	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Too sandy	Favorable.
CpA*:						
Colombo	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Too sandy	Favorable.
Urban land.						
CvB Cordeston	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
CwB*:						
Cordeston	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
CwB*:						
Marshbrook	Severe: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
CxC*:						
Cordeston	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Winetti	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Favorable	Droughty.
DgB*:						
Demar	Slight	Moderate: hard to pack, excess salt.	Deep to water	Droughty, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty.
Grummit	Severe: seepage.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Area reclaim	Droughty, area reclaim.
Slickspots.						
GbA Glenberg	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
GrD*, GrF*:						
Grummit	Severe: seepage, slope.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim.	Slope, droughty, area reclaim.
Rock outcrop.						
GuC*:						
Gurney	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Slope, thin layer.	Large stones, depth to rock.	Large stones, depth to rock.
Butche	Severe: depth to rock, seepage.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, droughty.	Large stones, depth to rock.	Large stones, depth to rock.
GvD*:						
Gypnevee	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily, thin layer.	Slope, erodes easily.	Too arid, slope, erodes easily.
Rekop	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, thin layer, erodes easily.	Slope, area reclaim, erodes easily.	Area reclaim, slope, erodes easily.
Rock outcrop.						
GyD*:						
Gypnevee	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily, thin layer.	Slope, erodes easily, area reclaim.	Area reclaim, slope, erodes easily.
Rock outcrop.						

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
GyD*:						
Urban land.						
HaA---------------Haverson	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Favorable------	Favorable.
HeE---------------Heely	Severe: slope.	Severe: piping, large stones.	Deep to water	Slope, large stones, thin layer.	Slope, large stones, depth to rock.	Large stones, slope.
HfC*:						
Heely------------	Severe: slope.	Severe: piping, large stones.	Deep to water	Slope, large stones, thin layer.	Slope, large stones, depth to rock.	Large stones, slope.
Cordeston--------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope----------	Slope.
HgB---------------Hilger	Moderate: seepage, slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Large stones---	Large stones, droughty.
HgD---------------Hilger	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
HmE*:						
Hilger-----------	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Metre------------	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, percs slowly.
HnB*:						
Hilger-----------	Moderate: seepage, slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Large stones---	Large stones, droughty.
Urban land.						
HoD*:						
Hilger-----------	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Virkula----------	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
HtG*:						
Hopdraw----------	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.
Sawdust----------	Severe: slope.	Severe: piping, large stones.	Deep to water	Large stones, rooting depth, slope.	Slope, large stones.	Large stones, slope, rooting depth.
Rock outcrop.						

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
JhD*:						
Judy	Severe: slope.	Severe: thin layer.	Deep to water	Slope, percs slowly, thin layer.	Slope, depth to rock, area reclaim.	Slope, erodes easily, depth to rock.
Heath	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
Paunsaugunt Variant	Severe: depth to rock, seepage, slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
MhA Marshbrook	Severe: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
MnC*:						
Metre	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Area reclaim, erodes easily.	Erodes easily, percs slowly.
Norrest	Moderate: seepage, slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Area reclaim, erodes easily.	Erodes easily, area reclaim.
MsC Mocmont	Severe: seepage.	Moderate: thin layer, large stones.	Deep to water	Slope, droughty.	Large stones	Large stones, droughty.
MtE*:						
Mocmont	Severe: seepage, slope.	Moderate: thin layer, large stones.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.
Rock outcrop.						
NaC Nevee	Severe: slope.	Severe: piping, large stones.	Deep to water	Slope, large stones.	Slope, large stones, erodes easily.	Large stones, slope.
NbC Nevee	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
NcE*:						
Nevee	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Gullied land.						
NfE*:						
Nihill	Severe: seepage, slope.	Moderate: thin layer.	Deep to water	Slope, droughty.	Slope	Slope, droughty.
Zigweid	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
NnE*:						
Norrest	Severe: slope.	Moderate: piping, hard to pack, large stones.	Deep to water	Slope, thin layer, large stones.	Slope, area reclaim, large stones.	Large stones, slope.
Fairburn	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
Metre	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, area reclaim, erodes easily.	Slope, erodes easily, percs slowly.
PaE*:						
Pactola	Severe: slope.	Severe: piping, large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
Virkula	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Rock outcrop.						
PbD*:						
Paunsaugunt	Severe: depth to rock, seepage, slope.	Severe: thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Gurney	Severe: slope.	Severe: piping.	Deep to water	Slope, thin layer.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
PcD*:						
Paunsaugunt	Severe: depth to rock, seepage, slope.	Severe: thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
PgC*:						
Pierre	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Area reclaim, erodes easily.	Erodes easily, area reclaim.
Grummit	Severe: seepage.	Severe: hard to pack, thin layer.	Deep to water	Slope, droughty, slow intake.	Area reclaim	Droughty, area reclaim.
Pt*. Pits						
ReC*:						
Redbird	Moderate: seepage, slope.	Severe: large stones.	Deep to water	Large stones, slope.	Large stones	Large stones.
Heath	Moderate: slope.	Moderate: hard to pack.	Deep to water	Slope, percs slowly.	Percs slowly	Percs slowly.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
RfE*:						
Rekop	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, thin layer, erodes easily.	Slope, area reclaim, erodes easily.	Area reclaim, slope, erodes easily.
Gypnevee	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Area reclaim, slope, erodes easily.
Rock outcrop.						
RgG*: Rock outcrop.						
Buska	Severe: slope.	Severe: piping.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
RhD*: Rock outcrop.						
Butche	Severe: depth to rock, seepage, slope.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
RkG*: Rock outcrop.						
Mocmont	Severe: seepage, slope.	Moderate: thin layer, large stones.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.
RlG*: Rock outcrop.						
Pactola	Severe: slope.	Severe: piping, large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
RmG*: Rock outcrop.						
Rekop	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope, thin layer, erodes easily.	Slope, area reclaim, erodes easily.	Area reclaim, slope, erodes easily.
RnG*: Rock outcrop.						
Sawdust	Severe: slope.	Severe: piping, large stones.	Deep to water	Large stones, rooting depth, slope.	Slope, large stones.	Large stones, slope, rooting depth.
RpC*:						
Rockoa	Severe: seepage.	Severe: piping, large stones.	Deep to water	Slope, large stones.	Large stones	Large stones.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
RpC*:						
Lakoa	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
RrE*:						
Rockoa	Severe: seepage, slope.	Severe: piping, large stones.	Deep to water	Slope, large stones.	Slope, large stones.	Large stones, slope.
Lakoa	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope	Slope.
Rock outcrop.						
RsF*:						
Rockoa	Severe: seepage, slope.	Severe: piping, large stones.	Deep to water	Slope, large stones.	Slope, large stones.	Large stones, slope.
Rock outcrop.						
RtD*:						
Rockoa	Severe: seepage, slope.	Severe: piping, large stones.	Deep to water	Slope, large stones.	Slope, large stones.	Large stones, slope.
Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
SeB Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
SfB*:						
Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Arvada	Moderate: slope.	Severe: excess sodium.	Deep to water	Slope, droughty, soil blowing.	Soil blowing, percs slowly.	Percs slowly, excess sodium.
ShD*:						
Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Canyon	Severe: seepage, slope.	Severe: piping, thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
SpE*:						
Sawdust	Severe: slope.	Severe: piping, large stones.	Deep to water	Large stones, rooting depth, slope.	Slope, large stones.	Large stones, slope, rooting depth.
Hopdraw	Severe: seepage, slope.	Severe: seepage, large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, too sandy.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
SpE*:						
Paunsaugunt	Severe: depth to rock, seepage, slope.	Severe: thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
SrE*:						
Sawdust	Severe: slope.	Severe: piping, large stones.	Deep to water	Large stones, rooting depth, slope.	Slope, large stones.	Large stones, slope, rooting depth.
Vanocker	Severe: slope.	Severe: piping.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.
Paunsaugunt	Severe: depth to rock, seepage, slope.	Severe: thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
SwE: Shirttail	Severe: slope.	Severe: piping, large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
SxaE*:						
Spearfish	Severe: seepage, slope.	Severe: piping, thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim.	Slope, area reclaim.
Nevee	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
SxbF*:						
Spearfish	Severe: seepage, slope.	Severe: piping, thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim.	Slope, area reclaim.
Rock outcrop.						
SyaC: Stovho	Severe: slope.	Severe: piping.	Deep to water	Slope, percs slowly, erodes easily.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
SybC*:						
Stovho	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, percs slowly, erodes easily.	Large stones, erodes easily.	Large stones, erodes easily.
Lail	Moderate: slope.	Slight	Deep to water	Slope, percs slowly.	Erodes easily	Erodes easily, percs slowly.
Trebor	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope.
SycE*:						
Stovho	Severe: slope.	Severe: piping.	Deep to water	Slope, percs slowly, erodes easily.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
SycE*:						
Trebor	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope.
TfA Tilford	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
TfB Tilford	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
TfC Tilford	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
TpC*:						
Tilford	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Paunsaugunt	Severe: depth to rock.	Severe: thin layer.	Deep to water	Slope, large stones, droughty.	Large stones, depth to rock.	Large stones, droughty.
TrB*:						
Tilford	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Urban land.						
TuG*:						
Trebor	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope.
Rock outcrop.						
VcE*:						
Vanocker	Severe: slope.	Severe: piping.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.
Citadel	Severe: slope.	Moderate: thin layer, hard to pack, large stones.	Deep to water	Slope, percs slowly, rooting depth.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
VkE*:						
Vanocker	Severe: slope.	Severe: piping.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.
Lakoa	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope	Slope.
VnC*:						
Vanocker	Severe: slope.	Severe: piping.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
VnC*:						
Paunsaugunt------	Severe: depth to rock, seepage, slope.	Severe: thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
VoG*:						
Vanocker---------	Severe: slope.	Severe: piping.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.
Sawdust----------	Severe: slope.	Severe: piping, large stones.	Deep to water	Large stones, rooting depth, slope.	Slope, large stones.	Large stones, slope, rooting depth.
Rock outcrop.						
VpC*:						
Virkula----------	Severe: slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Pactola----------	Severe: slope.	Severe: piping, large stones.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
WtB-------------- Winetti	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Favorable------	Droughty.
ZcC*:						
Zigweid----------	Severe: slope.	Moderate: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Canyon-----------	Severe: seepage, slope.	Severe: piping, thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
ZnD*:						
Zigweid----------	Severe: slope.	Moderate: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Nihill-----------	Severe: seepage, slope.	Moderate: thin layer.	Deep to water	Slope, droughty.	Slope----------	Too arid, slope, droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
ApA-------------- Arvada Variant	0-2	Loam-------------	ML, CL-ML, CL	A-4, A-6	0	100	100	80-100	60-75	30-40	5-15
	2-10	Clay, silty clay loam, clay loam.	CH, MH	A-7	0	100	100	85-100	75-95	50-70	20-40
	10-36	Clay loam, silty clay loam.	CL, CH	A-7	0	100	100	85-100	70-90	40-60	15-30
	36-60	Clay loam, silty clay loam, loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	60-90	35-55	12-27
AsA*:											
Arvada----------	0-3	Fine sandy loam	SM	A-4	0	80-100	75-100	60-80	35-50	15-20	NP-5
	3-12	Clay, silty clay loam, clay loam.	CL, CH	A-7	0	80-100	75-100	70-100	65-95	40-65	20-35
	12-60	Clay loam, silty clay loam, clay.	CL	A-7	0	80-100	75-100	70-100	55-90	40-50	15-25
Slickspots.											
BdA-------------- Barnum	0-2	Very fine sandy loam.	ML	A-4	0	85-100	85-100	70-95	50-65	20-25	NP-5
	2-60	Stratified clay loam to fine sandy loam.	CL	A-6	0	85-100	85-100	70-95	50-75	30-40	10-20
BeB*:											
Barnum----------	0-2	Very fine sandy loam.	ML	A-4	0	85-100	85-100	70-95	50-65	20-25	NP-5
	2-60	Stratified clay loam to fine sandy loam.	CL	A-6	0	85-100	85-100	70-95	50-75	30-40	10-20
Winetti---------	0-5	Cobbly loam------	SM, SM-SC, ML, CL-ML	A-4	20-30	75-85	70-80	50-70	40-60	20-30	NP-10
	5-30	Very gravelly sandy loam, sandy loam, loamy sand.	SM	A-2, A-1	0	70-100	40-90	35-65	15-35	15-25	NP-5
	30-60	Very cobbly sandy loam.	GM, SM, GP-GM, SP-SM	A-1	0-40	35-60	25-50	15-30	5-15	---	NP
BrA, BrB--------- Bullflat	0-6	Silt loam--------	CL, ML	A-4, A-6	0-10	95-100	95-100	90-100	80-95	30-40	5-15
	6-21	Silty clay loam, silt loam, clay loam.	CL	A-7, A-6	0-15	95-100	85-100	80-100	75-85	35-50	11-25
	21-28	Silt loam, silty clay loam, clay loam.	CL	A-6, A-4, A-7	0-25	95-100	85-100	75-90	70-85	30-50	8-25
	28-60	Gravelly clay loam, very gravelly clay loam, very cobbly clay loam.	CL, ML, SC, SM	A-6, A-4, A-7	5-50	80-100	55-80	50-75	40-70	30-45	7-20

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
BsB*:											
Bullflat	0-6	Silt loam	CL, ML	A-4, A-6	0-10	95-100	95-100	90-100	80-95	30-40	5-15
	6-21	Silty clay loam, silt loam, clay loam.	CL	A-7, A-6	0-15	95-100	85-100	80-100	75-85	35-50	11-25
	21-28	Silt loam, silty clay loam, clay loam.	CL	A-6, A-4, A-7	0-25	95-100	85-100	75-90	70-85	30-50	8-25
	28-60	Gravelly clay loam, very gravelly clay loam, very cobbly clay loam.	CL, ML, SC, SM	A-6, A-4, A-7	5-50	80-100	55-80	50-75	40-70	30-45	7-20
Cordeston	0-10	Loam	ML, CL-ML	A-4	0	85-100	85-100	80-90	60-70	20-25	NP-5
	10-45	Loam, very fine sandy loam, silt loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	80-90	60-70	25-35	5-15
	45-60	Loam, very fine sandy loam, clay loam.	CL, CL-ML, ML	A-6, A-4	0	85-100	85-100	85-95	60-80	20-35	NP-15
BtE*:											
Buska	0-12	Loam	ML, CL, CL-ML	A-4, A-6	0-5	90-100	80-95	70-85	55-75	25-40	5-15
	12-15	Channery loam, channery silt loam.	ML, CL, CL-ML	A-4, A-6	0-10	80-100	70-100	60-80	50-65	25-40	5-15
	15-41	Very channery loam, extremely channery loam, very channery silt loam.	CL-ML, GC, SC, CL	A-4, A-6	10-50	70-100	60-100	50-85	40-75	25-40	5-15
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Mocmont	0-12	Gravelly loam	SM-SC, SM, SC	A-1, A-2, A-4	5-10	70-80	55-75	35-75	15-45	20-30	5-10
	12-50	Very gravelly clay loam, very gravelly sandy clay loam.	GC, SC, GP-GC, SP-SC	A-2, A-6	10-20	45-85	30-60	20-50	10-40	25-35	10-20
	50-60	Extremely gravelly loam, extremely gravelly sandy loam, very gravelly loam.	GM, GP-GM, GM-GC	A-1, A-2	10-25	30-55	30-50	20-45	10-30	<25	NP-5
Rock outcrop.											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
BuE*:											
Buska-----------	0-12	Loam-------------	ML, CL, CL-ML	A-4, A-6	0-5	90-100	80-95	70-85	55-75	25-40	5-15
	12-15	Channery loam, channery silt loam.	ML, CL, CL-ML	A-4, A-6	0-10	80-100	70-100	60-80	50-65	25-40	5-15
	15-41	Very channery loam, extremely channery loam, very channery silt loam.	CL-ML, GC, SC, CL	A-4, A-6	10-50	70-100	60-100	50-85	40-75	25-40	5-15
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
BvC*:											
Buska-----------	0-12	Loam-------------	ML, CL, CL-ML	A-4, A-6	0-5	90-100	80-95	70-85	55-75	25-40	5-15
	12-15	Channery loam, channery silt loam.	ML, CL, CL-ML	A-4, A-6	0-10	80-100	70-100	60-80	50-65	25-40	5-15
	15-41	Very channery loam, extremely channery loam, very channery silt loam.	CL-ML, GC, SC, CL	A-4, A-6	10-50	70-100	60-100	50-85	40-75	25-40	5-15
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Virkula---------	0-13	Loam-------------	ML, CL	A-4, A-6	0	90-100	75-100	60-95	50-85	30-40	5-15
	13-45	Clay loam, silty clay loam, silt loam.	CL, CH, ML, CH	A-7, A-6	0-5	90-100	85-100	85-100	80-95	35-55	11-25
	45-60	Channery silty clay loam, very channery silty clay loam, clay loam.	CL, SC	A-6, A-7, A-2, A-4	0-15	90-100	40-85	35-75	25-60	30-50	8-25
BwE*:											
Butche----------	0-4	Cobbly loam------	SM, SC, ML, CL	A-4, A-6	15-35	70-100	60-100	60-100	35-70	25-40	3-15
	4-10	Cobbly loam, fine sandy loam, channery fine sandy loam.	ML, CL, SM, SC	A-4, A-6	15-45	75-100	60-100	60-100	35-65	25-40	3-15
	10-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
CcE*:											
Canyon----------	0-4	Loam-------------	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	4-18	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CcE*:											
Bridget---------	0-9	Very fine sandy loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	2-10
	9-17	Very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	2-10
	17-60	Very fine sandy loam, loam, silt loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-100	80-100	20-35	2-10
CdF*:											
Canyon----------	0-4	Loam-------------	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	4-18	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
CkC*:											
Citadel---------	0-10	Loam-------------	CL, ML	A-6, A-4	0-5	95-100	95-100	85-100	55-80	25-40	3-15
	10-34	Clay loam, clay	CL, CH	A-6, A-7	0-25	90-100	75-100	70-100	65-95	35-55	15-30
	34-42	Loam, clay loam, gravelly clay loam.	CL	A-6, A-7	5-30	85-100	70-100	65-100	60-95	30-50	10-25
	42-60	Gravelly clay loam, loam, clay loam.	CL, CL-ML	A-6, A-7, A-4	5-40	85-100	65-100	60-100	55-95	25-45	5-20
Vanocker--------	0-2	Channery loam----	ML, CL, SM, SC	A-4, A-6, A-7	0-10	60-80	55-75	50-70	45-70	30-45	7-20
	2-13	Gravelly silty clay loam, very channery clay loam, very channery clay loam.	CL, SC, GC	A-6, A-7	5-15	60-80	50-70	45-65	40-60	30-45	10-20
	13-60	Very gravelly silt loam, very gravelly loam, very channery loam.	CL, GC, ML, GM	A-6, A-4	5-25	50-70	40-60	40-55	35-55	30-40	7-15
CoA------------- Colombo	0-10	Loam-------------	ML	A-4	0	95-100	80-100	75-90	50-70	25-35	NP-10
	10-60	Stratified clay loam to sand.	ML	A-4, A-6	0-5	90-100	75-100	70-90	50-60	30-40	5-15
CpA*:											
Colombo---------	0-10	Loam-------------	ML	A-4	0	95-100	80-100	75-90	50-70	25-35	NP-10
	10-60	Stratified clay loam to sand.	ML	A-4, A-6	0-5	90-100	75-100	70-90	50-60	30-40	5-15
Urban land.											
CvB------------- Cordeston	0-10	Loam-------------	ML	A-4	0	85-100	85-100	80-90	60-70	20-25	NP-5
	10-45	Loam, very fine sandy loam, silt loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	80-90	60-70	25-35	5-15
	45-60	Loam, very fine sandy loam, clay loam.	CL, CL-ML, ML	A-6, A-4	0	85-100	85-100	85-95	60-80	20-35	NP-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
CwB*:											
Cordeston-------	0-10	Loam-------------	ML	A-4	0	85-100	85-100	80-90	60-70	20-25	NP-5
	10-45	Loam, very fine sandy loam, silt loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	80-90	60-70	25-35	5-15
	45-60	Loam, very fine sandy loam, clay loam.	CL, CL-ML, ML	A-6, A-4	0	85-100	85-100	85-95	60-80	20-35	NP-15
Marshbrook------	0-25	Loam-------------	ML	A-4	0	100	95-100	90-100	65-85	30-40	5-10
	25-41	Clay loam, loam	ML, MH	A-4, A-5, A-7, A-6	0-5	95-100	90-100	85-95	60-85	35-55	5-20
	41-60	Gravelly loam, gravelly sandy loam.	ML, SM	A-2, A-4	0-15	90-100	50-90	45-90	30-80	20-35	NP-10
CxC*:											
Cordeston-------	0-10	Loam-------------	ML	A-4	0	85-100	85-100	80-90	60-70	20-25	NP-5
	10-32	Loam, very fine sandy loam, silt loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	80-90	60-70	25-35	5-15
	32-60	Loam, very fine sandy loam, clay loam.	CL, CL-ML, ML	A-6, A-4	0	85-100	85-100	85-95	60-80	20-35	NP-15
Winetti---------	0-5	Cobbly loam------	SM, SM-SC, ML, CL-ML	A-4	20-30	75-85	70-80	50-70	40-60	20-30	NP-10
	5-30	Very gravelly sandy loam, sandy loam, loamy sand.	SM	A-2, A-1	0	70-100	40-90	35-65	15-35	15-25	NP-5
	30-60	Very cobbly sandy loam.	GM, SM, GP-GM, SP-SM	A-1	0-40	35-60	25-50	15-30	5-15	---	NP
DgB*:											
Demar-----------	0-5	Clay loam--------	CL, CL-ML	A-4, A-6, A-7	0	100	100	95-100	65-80	25-45	5-20
	5-17	Clay loam, clay	CL, CH	A-7	0	100	100	90-100	70-95	40-60	20-35
	17-35	Clay loam, clay	CL, CH	A-7	0	100	100	90-100	70-95	40-60	20-35
	35-60	Clay loam, clay	CL, CH	A-7	0	100	100	90-100	70-95	40-60	20-35
Grummit---------	0-4	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	85-100	50-65	20-35
	4-16	Clay-------------	CH, MH	A-7	0	95-100	85-100	75-100	65-100	50-65	15-30
	16-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Slickspots.											
GbA-------------- Glenberg	0-5	Fine sandy loam	SM, SM-SC	A-4, A-2	0	95-100	85-100	60-80	30-45	20-30	NP-7
	5-60	Stratified loamy sand to loam.	SM	A-2, A-4	0	90-100	75-100	50-70	25-40	20-25	NP-5
GrD*:											
Grummit---------	0-4	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	85-100	50-65	20-35
	4-16	Clay-------------	CH, MH	A-7	0	95-100	85-100	75-100	65-100	50-65	15-30
	16-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
GrF*:											
Grummit	0-4	Clay	CH, MH	A-7	0	95-100	95-100	90-100	85-100	50-65	20-35
	4-16	Clay	CH, MH	A-7	0	95-100	85-100	75-100	65-100	50-65	15-30
	16-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
GuC*:											
Gurney	0-5	Loam	CL, ML	A-4, A-6	0-10	95-100	90-100	85-100	80-95	30-40	5-15
	5-16	Loam, silty clay loam, clay loam.	CL	A-6, A-7	0-15	85-100	70-100	65-90	55-85	35-50	11-25
	16-28	Loam, clay loam, channery clay loam.	CL, ML	A-4, A-6, A-7	0-30	80-100	70-100	65-90	55-85	30-50	5-25
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Butche	0-4	Cobbly loam	SM, SC, ML, CL	A-4, A-6	15-35	70-100	60-100	60-100	35-70	25-40	3-15
	4-10	Cobbly loam, fine sandy loam, channery fine sandy loam.	ML, CL, SM, SC	A-4, A-6	15-45	75-100	60-100	60-100	35-65	25-40	3-15
	10-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
GvD*:											
Gypnevee	0-8	Silt loam	CL-ML, CL	A-4	0	100	100	95-100	75-85	20-25	5-10
	8-41	Silt loam, loam	CL-ML, CL	A-4	0	100	100	95-100	75-85	20-25	5-10
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rekop	0-4	Loam	CL-ML	A-4	0-5	95-100	95-100	85-95	60-75	15-35	5-10
	4-12	Gravelly loam, loam.	GM, ML, SM	A-4	0-10	60-100	55-95	45-80	35-65	30-35	5-10
	12-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
GyD*:											
Gypnevee	0-8	Silt loam	CL-ML, CL	A-4	0	100	100	95-100	75-85	20-25	5-10
	8-41	Silt loam, loam	CL-ML, CL	A-4	0	100	100	95-100	75-85	20-25	5-10
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Urban land.											
HaA Haverson	0-4	Loam	ML	A-4	0	95-100	90-100	85-100	55-90	25-35	NP-10
	4-60	Stratified clay loam to gravelly sandy loam.	CL, CL-ML	A-4, A-6	0	95-100	85-100	70-95	50-70	25-40	5-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HeE--------------- Heely	0-6	Channery loam----	ML, CL-ML	A-4	15-45	80-95	65-90	55-80	50-65	25-35	3-10
	6-17	Very flaggy loam, very flaggy sandy loam, flaggy clay loam.	ML, CL-ML, SM, SM-SC	A-4, A-2	45-70	60-95	35-75	30-70	25-65	25-35	3-10
	17-27	Extremely flaggy sandy loam, extremely flaggy loam.	ML, CL-ML, SM, SM-SC	A-4, A-2	45-75	50-90	35-70	30-65	25-55	25-35	3-10
	27-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HfC*:											
Heely-----------	0-6	Channery loam----	ML, CL-ML	A-4	15-45	80-95	65-90	55-80	50-65	25-35	3-10
	6-17	Very flaggy loam, very flaggy sandy loam, flaggy clay loam.	ML, CL-ML, SM, SM-SC	A-4, A-2	45-70	60-95	35-75	30-70	25-65	25-35	3-10
	17-27	Extremely flaggy sandy loam, extremely flaggy loam.	ML, CL-ML, SM, SM-SC	A-4, A-2	45-75	50-90	35-70	30-65	25-55	25-35	3-10
	27-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Cordeston-------	0-10	Loam-------------	ML, CL-ML	A-4	0	85-100	85-100	80-90	60-70	20-25	NP-5
	10-45	Loam, very fine sandy loam, silt loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	80-90	60-70	25-35	5-15
	45-60	Loam, very fine sandy loam, clay loam.	CL, CL-ML, ML	A-6, A-4	0	85-100	85-100	85-95	60-80	20-35	NP-15
HgB, HgD--------- Hilger	0-5	Cobbly loam------	SM-SC, CL-ML, CL, SC	A-4	15-30	60-95	60-80	45-80	35-60	25-30	5-10
	5-18	Very cobbly clay loam, very cobbly loam.	GC, CL, SC	A-6, A-2	35-55	55-85	50-80	40-75	30-70	30-40	10-15
	18-26	Extremely cobbly loam, very cobbly loam.	GM-GC, CL-ML, GC, CL	A-2, A-4, A-1	35-65	40-75	30-70	25-65	20-60	25-30	5-10
	26-60	Extremely cobbly loam.	GM-GC, GC	A-2, A-1	50-70	40-55	30-45	25-40	20-35	25-30	5-10
HmE*:											
Hilger----------	0-6	Cobbly loam------	SM-SC, CL-ML, CL, SC	A-4	15-30	60-95	60-80	45-80	35-60	25-30	5-10
	6-18	Very cobbly clay loam, very cobbly loam.	GC, CL, SC	A-6, A-2	35-55	55-85	50-80	40-75	30-70	30-40	10-15
	18-28	Extremely cobbly loam, very cobbly loam.	GM-GC, CL-ML, GC, CL	A-2, A-4, A-1	35-65	40-75	30-70	25-65	20-60	25-30	5-10
	28-60	Extremely cobbly loam.	GM-GC, GC	A-2, A-1	50-70	40-55	30-45	25-40	20-35	25-30	5-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HmE*:											
Metre-----------	0-5	Clay-------------	CH, MH	A-7	0	100	100	95-100	85-100	55-80	25-45
	5-26	Clay-------------	CH, MH	A-7	0	100	95-100	95-100	85-100	65-85	35-45
	26-36	Silty clay, clay	CH, MH	A-7	0	100	90-100	70-100	60-100	65-85	35-45
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
HnB*:											
Hilger----------	0-5	Cobbly loam------	SM-SC, CL-ML, CL, SC	A-4	15-30	60-95	60-80	45-80	35-60	25-30	5-10
	5-18	Very cobbly clay loam, very cobbly loam.	GC, CL, SC	A-6, A-2	35-55	55-85	50-80	40-75	30-70	30-40	10-15
	18-26	Extremely cobbly loam, very cobbly loam.	GM-GC, CL-ML, GC, CL	A-2, A-4, A-1	35-65	40-75	30-70	25-65	20-60	25-30	5-10
	26-60	Extremely cobbly loam.	GM-GC, GC	A-2, A-1	50-70	40-55	30-45	25-40	20-35	25-30	5-10
Urban land.											
HoD*:											
Hilger----------	0-5	Cobbly loam------	SM-SC, CL-ML, CL, SC	A-4	15-30	60-95	60-80	45-80	35-60	25-30	5-10
	5-18	Very cobbly clay loam, very cobbly loam.	GC, CL, SC	A-6, A-2	35-55	55-85	50-80	40-75	30-70	30-40	10-15
	18-26	Extremely cobbly loam, very cobbly loam.	GM-GC, CL-ML, GC, CL	A-2, A-4, A-1	35-65	40-75	30-70	25-65	20-60	25-30	5-10
	26-60	Extremely cobbly loam.	GM-GC, GC	A-2, A-1	50-70	40-55	30-45	25-40	20-35	25-30	5-10
Virkula---------	0-4	Silt loam--------	CL-ML, CL	A-4, A-6	0	90-100	75-100	60-100	55-95	25-40	5-15
	4-45	Clay loam, silty clay loam, silt loam.	CL, CH, ML, CH	A-7, A-6	0-5	90-100	85-100	85-100	80-95	35-55	11-25
	45-60	Cobbly clay loam, very gravelly clay loam, clay loam.	CL, SC	A-6, A-7, A-2, A-4	0-25	90-100	40-85	35-75	25-60	30-50	8-25
HtG*:											
Hopdraw---------	0-3	Cobbly loamy fine sand.	SM, SM-SC, GM, GM-GC	A-2, A-4	15-55	60-90	50-85	45-80	25-40	<25	NP-7
	3-44	Very gravelly loamy fine sand, very gravelly fine sand, very cobbly loamy fine sand.	SM, SM-SC, GM, GM-GC	A-1, A-2	25-60	45-80	30-70	25-65	15-35	<25	NP-7
	44-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HtG*:											
Sawdust---------	0-4	Channery loam----	ML, CL	A-4, A-6, A-7	15-50	70-100	60-90	55-80	50-70	30-45	7-20
	4-8	Very channery loam, very channery silt loam.	CL, SC, GC	A-4, A-6, A-7	30-60	60-80	50-75	45-60	35-55	30-45	8-20
	8-60	Extremely channery sandy loam, extremely channery loam, extremely flaggy loam.	CL, SC, CL-ML, SM-SC	A-2, A-4, A-6	40-70	45-70	35-70	30-60	25-55	25-40	7-15
Rock outcrop.											
JhD*:											
Judy------------	0-6	Silt loam--------	CL-ML	A-4	0-5	90-100	85-100	80-100	70-90	25-35	5-10
	6-24	Silty clay loam, silty clay.	CH, CL	A-7	0-5	90-100	75-100	75-100	75-95	40-60	20-40
	24-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Heath-----------	0-7	Silt loam--------	ML	A-4	0	95-100	90-100	85-95	60-75	30-40	5-10
	7-36	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0	95-100	85-100	80-100	70-90	40-60	20-40
	36-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	90-100	75-100	70-100	65-85	30-50	15-25
Paunsaugunt Variant--------	0-4	Gravelly silt loam.	GM-GC, GC, SM-SC, SC	A-2, A-4	0-5	50-80	45-75	35-65	30-50	20-30	5-10
	4-11	Gravelly loam, very gravelly loam.	GM-GC, GM, GC	A-1, A-2, A-4	5-25	45-65	35-55	25-50	20-45	15-30	NP-10
	11-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
MhA-------------- Marshbrook	0-25	Loam, clay loam	ML	A-4	0	100	95-100	90-100	65-85	30-40	5-10
	25-41	Clay loam, loam	ML, MH	A-4, A-5, A-7, A-6	0-5	95-100	90-100	85-95	60-85	35-55	5-20
	41-60	Gravelly loam, gravelly sandy loam.	ML, SM	A-2, A-4	0-15	90-100	50-90	45-90	30-80	20-35	NP-10
MnC*:											
Metre-----------	0-5	Clay-------------	CH, MH	A-7	0	100	100	95-100	85-100	55-80	25-45
	5-26	Clay-------------	CH, MH	A-7	0	100	95-100	95-100	85-100	65-85	35-45
	26-36	Silty clay, clay	CH, MH	A-7	0	100	90-100	70-100	60-100	65-85	35-45
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Norrest---------	0-4	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	70-95	35-45	12-20
	4-32	Silty clay loam, clay loam, silty clay.	CL, CH	A-7	0	100	100	85-100	60-95	40-65	15-35
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
MsC-------------- Mocmont	0-12	Gravelly loam----	SM-SC, SM, SC	A-1, A-2, A-4	5-10	70-80	55-75	35-75	15-45	20-30	5-10
	12-50	Very gravelly clay loam, very gravelly sandy clay loam.	GC, SC, GP-GC, SP-SC	A-2, A-6	10-20	45-85	30-60	20-50	10-40	25-35	10-20
	50-60	Extremely gravelly loam, extremely gravelly sandy loam, very gravelly loam.	GM, GP-GM, GM-GC	A-1, A-2	10-25	30-55	30-50	20-45	10-30	<25	NP-5
MtE*:											
Mocmont---------	0-12	Gravelly loam----	SM-SC, SM, SC	A-1, A-2, A-4	5-10	70-80	55-75	35-75	15-45	20-30	5-10
	12-50	Very gravelly clay loam, very gravelly sandy clay loam.	GC, SC, GP-GC, SP-SC	A-2, A-6	10-20	45-85	30-60	20-50	10-40	25-35	10-20
	50-60	Extremely gravelly loam, extremely gravelly sandy loam, very gravelly loam.	GM, GP-GM, GM-GC	A-1, A-2	10-25	30-55	30-50	20-45	10-30	<25	NP-5
Rock outcrop.											
NaC-------------- Nevee	0-8	Channery loam----	CL-ML, ML	A-4	20-50	90-100	90-100	90-100	80-100	20-30	NP-5
	8-60	Loam, silt loam, channery loam.	CL, CL-ML, ML	A-4, A-6	5-35	90-100	90-100	90-100	80-100	20-35	5-15
NbC-------------- Nevee	0-8	Silt loam--------	ML	A-4	0	100	100	95-100	80-100	20-30	NP-5
	8-60	Silt loam, loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-100	20-35	5-15
NcE*:											
Nevee-----------	0-8	Silt loam--------	ML	A-4	0	100	100	95-100	80-100	20-30	NP-5
	8-60	Silt loam, loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-100	20-35	5-15
Gullied land.											
NfE*:											
Nihill----------	0-7	Gravelly loam----	GM, SM, ML	A-2, A-4	0-5	60-85	50-75	35-65	30-60	25-35	NP-10
	7-60	Very gravelly loam, very gravelly sandy loam, very gravelly clay loam.	GM-GC, GC, GP-GC	A-2, A-1	0-15	30-60	25-50	15-40	10-35	25-40	5-15
Zigweid---------	0-4	Clay loam--------	CL	A-6	0	75-100	75-100	70-85	60-70	35-40	15-20
	4-60	Loam, clay loam	CL	A-6	0	75-100	75-100	70-85	60-70	25-40	10-20

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
NnE*:											
Norrest---------	0-4	Cobbly silty clay loam.	CL	A-6, A-7	20-45	95-100	95-100	85-100	70-95	35-45	12-20
	4-8	Cobbly silty clay loam, cobbly silty clay.	CL, CH	A-7	2-45	95-100	95-100	85-100	70-95	40-65	15-35
	8-32	Silty clay loam, silty clay.	CL, CH	A-7, A-6	0-10	100	100	85-100	60-95	25-65	11-35
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Fairburn--------	0-3	Cobbly silty clay loam.	ML, CL	A-6, A-7	15-25	95-100	90-100	85-100	80-95	30-45	10-20
	3-18	Silty clay loam, silt loam, clay loam.	ML, CL	A-6, A-7	0	90-100	85-100	85-100	75-100	35-50	10-25
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Metre-----------	0-5	Clay-------------	CH, MH	A-7	0	100	100	95-100	85-100	55-80	25-45
	5-26	Clay-------------	CH, MH	A-7	0	100	95-100	95-100	85-100	65-85	35-45
	26-36	Silty clay, clay	CH, MH	A-7	0	100	90-100	70-100	60-100	65-85	35-45
	36-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
PaE*:											
Pactola----------	0-11	Channery loam, channery silt loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-25	60-95	50-90	40-70	35-55	25-40	5-15
	11-18	Channery clay loam, very channery clay loam, very channery silty clay loam.	CL, SC, GC	A-4, A-6	35-55	60-95	45-90	45-75	40-65	28-40	8-20
	18-42	Extremely channery clay loam, very channery clay loam, extremely channery silty clay loam.	ML, CL, SC, SM	A-4, A-6, A-7	35-75	60-90	45-75	40-70	35-60	30-45	5-20
	42-60	Unweathered bedrock	---	---	---	---	---	---	---	---	---
Virkula----------	0-13	Loam------------	ML, CL	A-4, A-6	0	90-100	75-100	60-95	50-85	30-40	5-15
	13-45	Clay loam, silty clay loam, silt loam.	CL, CH ML,CH	A-7, A-6	0-5	90-100	85-100	85-100	50-95	35-55	11-25
	45-60	Channery silty clay loam, very channery silty clay loam, clay loam.	CL, SC	A-6, A-7, A-2, A-4	0-15	90-100	40-85	35-75	25-60	30-50	8-25
Rock outcrop.											
PbD*:											
Paunsaugunt------	0-6	Gravelly loam----	GC	A-2, A-6	0-5	50-65	50-65	35-55	25-50	20-35	10-15
	6-11	Very gravelly loam, very cobbly loam.	GM-GC, GM	A-1, A-2	5-50	40-65	40-65	40-65	20-45	15-25	NP-10
	11-60	Unweathered bedrock.									

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
PbD*:											
Gurney----------	0-5	Loam-------------	CL, ML	A-4, A-6	0-10	95-100	90-100	85-100	80-95	30-40	5-15
	5-16	Loam, silty clay loam, clay loam.	CL	A-6, A-7	0-15	85-100	70-100	65-90	55-85	35-50	11-25
	16-28	Loam, clay loam, channery clay loam.	CL, ML	A-4, A-6, A-7	0-30	80-100	70-100	65-90	55-85	30-50	5-25
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
PcD*:											
Paunsaugunt-----	0-6	Gravelly loam----	GC	A-2, A-6	0-5	50-65	50-65	35-55	25-50	20-35	10-15
	6-11	Very gravelly loam, very cobbly loam.	GM-GC, GM	A-1, A-2, A-4	5-50	40-65	40-65	40-65	20-45	15-25	NP-10
	11-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
PgC*:											
Pierre----------	0-4	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-80	29-45
	4-16	Clay-------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	30-50
	16-32	Clay-------------	CH, MH	A-7	0	100	95-100	90-100	80-100	60-90	30-50
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Grummit---------	0-4	Clay-------------	CH, MH	A-7	0	95-100	95-100	90-100	85-100	50-65	20-35
	4-16	Clay-------------	CH, MH	A-7	0	95-100	85-100	75-100	65-100	50-65	15-30
	16-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Pt*. Pits											
ReC*:											
Redbird---------	0-7	Silt loam--------	CL, ML	A-4, A-6	0-10	95-100	85-100	85-100	80-95	30-40	7-15
	7-20	Very cobbly silty clay loam, extremely cobbly silty clay loam.	SC, GC, CL	A-6, A-7	25-65	60-95	45-75	40-65	35-60	30-45	10-20
	20-24	Extremely cobbly silty clay loam, extremely cobbly clay loam.	SC, GC	A-2, A-6, A-7	30-65	50-80	35-65	30-55	25-50	30-45	10-20
	24-60	Extremely cobbly loam, very gravelly loam, very cobbly loam.	SC, GC	A-2, A-6, A-7	40-75	50-80	35-65	30-55	25-50	30-45	10-20
Heath-----------	0-7	Silt loam--------	ML	A-4	0	95-100	90-100	85-95	60-75	30-40	5-10
	7-36	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0	95-100	85-100	80-100	70-90	40-60	20-40
	36-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	90-100	75-100	70-100	65-85	30-50	15-25

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RfE*:											
Rekop	0-4	Loam	CL-ML	A-4	0-5	95-100	95-100	85-95	60-75	15-35	5-10
	4-12	Gravelly loam, loam.	GM, ML, SM	A-4	0-10	60-100	55-95	45-80	35-65	30-35	5-10
	12-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gypnevee	0-8	Silt loam	CL-ML, CL	A-4	0	100	100	95-100	75-85	20-25	5-10
	8-41	Silt loam, loam	CL-ML, CL	A-4	0	100	100	95-100	75-85	20-25	5-10
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
RgG*: Rock outcrop.											
Buska	0-12	Loam	ML, CL, CL-ML	A-4, A-6	0-5	90-100	80-95	70-85	55-75	25-40	5-15
	12-15	Channery loam, channery silt loam.	ML, CL, CL-ML	A-4, A-6	0-10	80-100	70-100	60-80	50-65	25-40	5-15
	15-41	Very channery loam, extremely channery loam, very channery silt loam.	CL-ML, GC, SC, CL	A-4, A-6	10-50	70-100	60-100	50-85	40-75	25-40	5-15
	41-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
RhD*: Rock outcrop.											
Butche	0-4	Cobbly loam	SM, SC, ML, CL	A-4, A-6	15-35	70-100	60-100	60-100	35-70	25-40	3-15
	4-10	Cobbly loam, fine sandy loam, channery fine sandy loam.	ML, CL, SM, SC	A-4, A-6	15-45	75-100	60-100	60-100	35-65	25-40	3-15
	10-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RkG*: Rock outcrop.											
Mocmont	0-12	Gravelly loam	SM-SC, SM, SC	A-1, A-2, A-4	5-10	70-80	55-75	35-75	15-45	20-30	5-10
	12-50	Very gravelly clay loam, very gravelly sandy clay loam.	GC, SC, GP-GC, SP-SC	A-2, A-6	10-20	45-85	30-60	20-50	10-40	25-35	10-20
	50-60	Extremely gravelly loam, extremely gravelly sandy loam, very gravelly loam.	GM, GP-GM, GM-GC	A-1, A-2	10-25	30-55	30-50	20-45	10-30	<25	NP-5
RlG*: Rock outcrop.											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification Unified	Classification AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
RlG*:											
Pactola---------	0-11	Channery loam, channery silt loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-25	60-95	50-90	40-70	35-55	25-40	5-15
	11-18	Channery clay loam, very channery clay loam, very channery silty clay loam.	CL, SC, GC	A-4, A-6	35-55	60-95	45-90	45-75	40-65	28-40	8-20
	18-42	Extremely channery clay loam, very channery clay loam, extremely channery silty clay loam.	ML, CL, SC, SM	A-4, A-6, A-7	35-75	60-90	45-75	40-70	35-60	30-45	5-20
	42-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RmG*: Rock outcrop.											
Rekop-----------	0-4	Loam-------------	CL-ML	A-4	0-5	95-100	95-100	85-95	60-75	15-35	5-10
	4-12	Gravelly loam, loam.	GM, ML, SM	A-4	0-10	60-100	55-95	45-80	35-65	30-35	5-10
	12-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RnG*: Rock outcrop.											
Sawdust---------	0-4	Channery loam----	ML, CL	A-4, A-6, A-7	15-50	70-100	60-90	55-80	50-70	30-45	7-20
	4-8	Very channery loam, very channery silt loam.	CL, SC, GC	A-4, A-6, A-7	30-60	60-80	50-75	45-60	35-55	30-45	8-20
	8-60	Extremely channery sandy loam, extremely channery loam, extremely flaggy loam.	CL, SC, CL-ML, SM-SC	A-2, A-4, A-6	40-70	45-70	35-70	30-60	25-55	25-40	7-15
RpC*:											
Rockoa----------	0-6	Cobbly fine sandy loam.	SM, SC, SM-SC	A-4	15-50	80-100	70-90	60-80	35-50	20-30	3-10
	6-22	Very stony fine sandy loam, stony sandy clay loam, very cobbly clay loam.	SC, SM, CL, ML	A-4, A-6	30-60	70-100	65-90	60-85	35-60	30-40	5-15
	22-60	Very stony fine sandy loam, very cobbly clay loam, extremely cobbly fine sandy loam.	SM, SC, SM-SC, GM	A-4, A-6	30-70	70-100	65-85	55-75	35-50	20-35	3-12

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RpC*:											
Lakoa-----------	0-5	Very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-35	5-15
	5-11	Sandy clay loam, sandy loam, clay loam.	CL, SC	A-4, A-6	0	100	100	70-90	40-70	30-40	8-15
	11-22	Clay loam, sandy clay loam.	CL	A-6, A-7	0-5	95-100	90-100	80-100	50-80	35-45	12-20
	22-33	Clay loam, sandy clay loam.	CL	A-4, A-6, A-7	0-5	95-100	85-100	80-100	50-80	30-45	8-20
	33-60	Gravelly loam, gravelly clay loam.	CL, SC	A-4, A-6	0-10	80-95	50-75	45-65	35-60	30-40	8-15
RrE*:											
Rockoa----------	0-6	Cobbly fine sandy loam.	SM, SC, SM-SC	A-4	15-50	80-100	70-90	60-80	35-50	20-30	3-10
	6-22	Very stony fine sandy loam, stony sandy clay loam, very cobbly clay loam.	SC, SM, CL, ML	A-4, A-6	30-60	70-100	65-90	60-85	35-60	30-40	5-15
	22-60	Very stony fine sandy loam, very cobbly clay loam, extremely cobbly fine sandy loam.	SM, SC, SM-SC, GM	A-4, A-6	30-70	70-100	65-85	55-75	35-50	20-35	3-12
Lakoa-----------	0-5	Very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-35	5-15
	5-11	Sandy clay loam, sandy loam, clay loam.	CL, SC	A-4, A-6	0	100	100	70-90	40-70	30-40	8-15
	11-22	Clay loam, sandy clay loam.	CL	A-6, A-7	0-5	95-100	90-100	80-100	50-80	35-45	12-20
	22-33	Clay loam, sandy clay loam.	CL	A-4, A-6, A-7	0-5	95-100	85-100	80-100	50-80	30-45	8-20
	33-60	Gravelly loam, gravelly clay loam.	CL, SC	A-4, A-6	0-10	80-95	50-75	45-65	35-60	30-40	8-15
Rock outcrop.											
RsF*:											
Rockoa----------	0-6	Cobbly fine sandy loam.	SM, SC, SM-SC	A-4	15-50	80-100	70-90	60-80	35-50	20-30	3-10
	6-22	Very stony fine sandy loam, stony sandy clay loam, very cobbly clay loam.	SC, SM, CL, ML	A-4, A-6	30-60	70-100	65-90	60-85	35-60	30-40	5-15
	22-60	Very stony fine sandy loam, very cobbly clay loam, extremely cobbly fine sandy loam.	SM, SC, SM-SC, GM	A-4, A-6	30-70	70-100	65-85	55-75	35-50	20-35	3-12

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RsF*: Rock outcrop.											
RtD*: Rockoa----------	0-6	Cobbly fine sandy loam.	SM, SC, SM-SC	A-4	15-50	80-100	70-90	60-80	35-50	20-30	3-10
	6-22	Very stony fine sandy loam, stony sandy clay loam, very cobbly clay loam.	SC, SM, CL, ML	A-4, A-6	30-60	70-100	65-90	60-85	35-60	30-40	5-15
	22-60	Very stony fine sandy loam, very cobbly clay loam, extremely cobbly fine sandy loam.	SM, SC, SM-SC, GM	A-4, A-6	30-70	70-100	65-85	55-75	35-50	20-35	3-12
Satanta---------	0-9	Fine sandy loam--	ML, SM,	A-4	0	100	95-100	60-85	45-60	22-25	NP-5
	9-26	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	26-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
SeB-------------- Satanta	0-9	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
	9-26	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	26-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
SfB*: Satanta---------	0-9	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
	9-26	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	26-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
Arvada----------	0-3	Fine sandy loam	SM	A-4	0	80-100	75-100	60-80	35-50	15-20	NP-5
	3-12	Clay, silty clay loam, clay loam.	CL, CH	A-7	0	80-100	75-100	70-100	65-95	40-65	20-35
	12-60	Clay loam, silty clay loam, clay.	CL	A-7	0	80-100	75-100	70-100	55-90	40-50	15-25
ShD*: Satanta---------	0-9	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
	9-26	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	26-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
Canyon----------	0-4	Loam-------------	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	4-18	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
SpE*:											
Sawdust---------	0-4	Channery loam----	ML, CL	A-4, A-6, A-7	15-50	70-100	60-90	55-80	50-70	30-45	7-20
	4-8	Very channery loam, very channery silt loam.	CL, SC, GC	A-4, A-6, A-7	30-60	60-80	50-75	45-60	35-55	30-45	8-20
	8-60	Extremely channery sandy loam, extremely channery loam, extremely flaggy loam.	CL, SC, CL-ML, SM-SC	A-2, A-4, A-6	40-70	45-70	35-70	30-60	25-55	25-40	7-15
Hopdraw---------	0-3	Cobbly loamy fine sand.	SM, SM-SC, GM, GM-GC	A-2, A-4	15-55	60-90	50-85	45-80	25-40	<25	NP-7
	3-44	Very gravelly loamy fine sand, very gravelly fine sand, very cobbly loamy fine sand.	SM, SM-SC, GM, GM-GC	A-1, A-2	25-60	45-80	30-70	25-65	15-35	<25	NP-7
	44-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Paunsaugunt-----	0-6	Gravelly loam----	GC	A-2, A-6	0-5	50-65	50-65	35-55	25-50	20-35	10-15
	6-11	Very gravelly loam, very cobbly loam.	GM-GC, GM	A-1, A-2, A-4	5-50	40-65	40-65	40-65	20-45	15-25	NP-10
	11-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SrE*:											
Sawdust---------	0-4	Channery loam----	ML, CL	A-4, A-6, A-7	15-50	70-100	60-90	55-80	50-70	30-45	7-20
	4-8	Very channery loam, very channery silt loam.	CL, SC, GC	A-4, A-6, A-7	30-60	60-80	50-75	45-60	35-55	30-45	8-20
	8-60	Extremely channery sandy loam, extremely channery loam, extremely flaggy loam.	CL, SC, CL-ML, SM-SC	A-2, A-4, A-6	40-70	45-70	35-70	30-60	25-55	25-40	7-15
Vanocker--------	0-2	Channery loam----	ML, CL, SM, SC	A-4, A-6, A-7	0-10	60-80	55-75	50-70	45-70	30-45	7-20
	2-13	Gravelly silty clay loam, very channery clay loam, very channery clay loam.	CL, SC, GC	A-6, A-7	5-15	60-80	50-70	45-65	40-60	30-45	10-20
	13-60	Very gravelly silt loam, very gravelly loam, very channery silt loam.	CL, GC, ML, GM	A-6, A-4	5-25	50-70	40-60	40-55	35-55	30-40	7-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SrE*:											
Paunsaugunt-----	0-6	Gravelly loam----	GC	A-2, A-6	0-5	50-65	50-65	35-55	25-50	20-35	10-15
	6-11	Very gravelly loam, very cobbly loam.	GM-GC, GM	A-1, A-2, A-4	5-50	40-65	40-65	40-65	20-45	15-25	NP-10
	11-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SwE-------------- Shirttail	0-6	Channery loam----	CL, CL-ML	A-4, A-6	20-40	80-100	70-90	60-80	50-70	25-40	5-15
	6-18	Very channery clay loam, very cobbly clay loam, very flaggy clay loam.	CL, SC, GC	A-6, A-7	40-75	60-95	55-85	45-80	40-65	30-50	10-25
	18-24	Very channery loam, very channery fine sandy loam, very cobbly loam.	CL, SC, GC	A-4, A-6	40-75	60-95	50-85	45-80	35-60	25-40	5-15
	24-44	Very channery loamy fine sand, very channery fine sandy loam, very channery loam.	ML, CL-ML, SM, SM-SC	A-2, A-4	50-80	60-95	50-85	45-75	30-55	20-35	NP-10
	44-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SxaE*:											
Spearfish-------	0-5	Silt loam--------	ML, CL	A-4, A-6	0	100	100	85-100	65-90	25-40	NP-15
	5-12	Loam, very fine sandy loam, silt loam.	ML, CL	A-4, A-6	0	95-100	80-100	70-100	50-90	25-40	NP-15
	12-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Nevee-----------	0-8	Silt loam--------	ML	A-4	0	100	100	95-100	80-100	20-30	NP-5
	8-60	Silt loam, loam, very fine sandy loam.	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-100	20-35	5-15
SxbF*:											
Spearfish-------	0-5	Silt loam--------	ML, CL	A-4, A-6	0	100	100	85-100	65-90	25-40	NP-15
	5-12	Loam, very fine sandy loam, silt loam.	ML, CL	A-4, A-6	0	95-100	80-100	70-100	50-90	25-40	NP-15
	12-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
SyaC------------- Stovho	0-6	Silt loam--------	ML, CL	A-4, A-6	0	100	95-100	95-100	85-100	25-40	3-15
	6-17	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	100	95-100	90-100	80-100	40-60	15-30
	17-30	Clay loam, silty clay loam, channery silty clay loam.	CL	A-6, A-7	0-20	90-100	80-100	75-100	70-100	35-50	11-25
	30-60	Clay loam, silty clay loam, channery silty clay loam.	ML, CL, SM, SC	A-4, A-6, A-7	0-50	60-95	50-90	45-85	35-80	30-50	5-25

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SybC*:											
Stovho----------	0-6	Silt loam--------	ML, CL	A-4, A-6	0	100	95-100	95-100	85-100	25-40	3-15
	6-17	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	100	95-100	90-100	80-100	40-60	15-30
	17-30	Clay loam, silty clay loam, channery silty clay loam.	CL	A-6, A-7	0-20	90-100	80-100	75-100	70-100	35-50	11-25
	30-60	Clay loam, silty clay loam, channery silty clay loam.	ML, CL, SM, SC	A-4, A-6, A-7	0-50	60-95	50-90	45-85	35-80	30-50	5-25
Lail------------	0-6	Silt loam--------	CL-ML, CL	A-4	0	80-100	75-100	70-100	50-90	20-30	5-10
	6-34	Clay, silty clay, clay loam.	CL, CH	A-7	0	80-100	75-100	70-100	65-95	40-55	20-30
	34-60	Clay loam--------	CL	A-6, A-7	0	80-100	75-100	70-100	55-80	35-45	15-20
Trebor----------	0-3	Channery silt loam.	CL, ML	A-4, A-6	0-15	80-100	70-100	60-80	50-65	30-40	5-15
	3-15	Very channery silty clay loam, very bouldery silty clay loam, channery silt loam.	CL, SC, GC	A-6, A-7, A-4	10-40	70-95	65-80	50-70	40-60	30-45	8-20
	15-30	Very channery silt loam, very channery clay loam, channery silt loam.	CL, SC, GC	A-6, A-7, A-4	30-60	65-90	55-80	45-65	35-55	30-45	8-20
	30-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
SycE*:											
Stovho----------	0-6	Silt loam--------	ML, CL	A-4, A-6	0	100	95-100	95-100	85-100	25-40	3-15
	6-17	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	100	95-100	90-100	80-100	40-60	15-30
	17-30	Clay loam, silty clay loam, channery silty clay loam.	CL	A-6, A-7	0-20	90-100	80-100	75-100	70-100	35-50	11-25
	30-60	Clay loam, silty clay loam, channery silty clay loam.	ML, CL, SM, SC	A-4, A-6, A-7	0-50	60-95	50-90	45-85	35-80	30-50	5-25

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SycE*:											
Trebor	0-3	Channery silt loam.	CL, ML	A-4, A-6	0-15	80-100	70-100	60-80	50-65	30-40	5-15
	3-15	Very channery silty clay loam, very bouldery silty clay loam, channery silt loam.	CL, SC, GC	A-6, A-7, A-4	10-40	70-95	65-80	50-70	40-60	30-45	8-20
	15-30	Very channery silt loam, very channery clay loam, channery silt loam.	CL, SC, GC	A-6, A-7, A-4	30-60	65-90	55-80	45-65	35-55	30-45	8-20
	30-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
TfA, TfB, TfC: Tilford	0-5	Silt loam	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	5-20	Silt loam, loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	20-60	Loam, silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	95-100	70-95	22-35	3-15
TpC*:											
Tilford	0-5	Silt loam	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	5-20	Silt loam, loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	20-60	Loam, silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	95-100	70-95	22-35	3-15
Paunsaugunt	0-6	Gravelly loam	GC	A-2, A-6	0-5	50-65	50-65	35-55	25-50	20-35	10-15
	6-11	Very gravelly loam, very cobbly loam.	GM-GC, GM	A-1, A-2, A-4	5-50	40-65	40-65	40-65	20-45	15-25	NP-10
	11-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
TrB*:											
Tilford	0-5	Silt loam	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	5-20	Silt loam, loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6	0	100	100	95-100	60-95	22-35	3-15
	20-60	Loam, silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6	0	95-100	95-100	95-100	70-95	22-35	3-15
Urban land.											

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
TuG*:											
Trebor----------	0-3	Channery silt loam.	CL, ML	A-4, A-6	0-15	80-100	70-100	60-80	50-65	30-40	5-15
	3-15	Channery clay loam, very channery silty clay loam, very flaggy silty clay loam.	CL, SC, GC	A-6, A-7, A-4	10-40	70-95	65-80	50-70	40-60	30-45	8-20
	15-30	Very flaggy loam, very channery clay loam, channery silt loam.	CL, SC, GC	A-6, A-7, A-4	30-60	65-90	55-80	45-65	35-55	30-45	8-20
	30-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
VcE*:											
Vanocker--------	0-2	Channery loam----	ML, CL, SM, SC	A-4, A-6, A-7	0-10	60-80	55-75	50-70	45-70	30-45	7-20
	2-13	Gravelly silty clay loam, very channery clay loam, very channery clay loam.	CL, SC, GC	A-6, A-7	5-15	60-80	50-70	45-65	40-60	30-45	10-20
	13-60	Very gravelly silt loam, very gravelly loam, very channery loam.	CL, GC, ML, GM	A-6, A-4	5-25	50-70	40-60	40-55	35-55	30-40	7-15
Citadel---------	0-10	Loam-------------	CL, ML	A-6, A-4	0-5	95-100	95-100	85-100	55-80	25-40	3-15
	10-34	Clay loam, clay	CL, CH	A-6, A-7	0-25	90-100	75-100	70-100	65-95	35-55	15-30
	34-42	Loam, clay loam, gravelly clay loam.	CL	A-6, A-7	5-30	85-100	70-100	65-100	60-95	30-50	10-25
	42-60	Gravelly clay loam, loam, clay loam.	CL, CL-ML	A-6, A-7, A-4	5-40	85-100	65-100	60-100	55-95	25-45	5-20
VkE*:											
Vanocker--------	0-2	Channery loam----	ML, CL, SM, SC	A-4, A-6, A-7	0-10	60-80	55-75	50-70	45-70	30-45	7-20
	2-13	Gravelly silty clay loam, very channery clay loam, very channery clay loam.	CL, SC, GC	A-6, A-7	5-15	60-80	50-70	45-65	40-60	30-45	10-20
	13-60	Very gravelly silt loam, very gravelly loam, very channery loam.	CL, GC, ML, GM	A-6, A-4	5-25	50-70	40-60	40-55	35-55	30-40	7-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
VkE*:											
Lakoa-----------	0-5	Very fine sandy loam.	CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	25-35	5-15
	5-11	Sandy clay loam, sandy loam, clay loam.	CL, SC	A-4, A-6	0	100	100	70-90	40-70	30-40	8-15
	11-22	Clay loam, sandy clay loam.	CL	A-6, A-7	0-5	95-100	90-100	80-100	50-80	35-45	12-20
	22-33	Clay loam, sandy clay loam.	CL	A-4, A-6, A-7	0-5	95-100	85-100	80-100	50-80	30-45	8-20
	33-60	Gravelly loam, gravelly clay loam.	CL, SC	A-4, A-6	0-10	80-95	50-75	45-65	35-60	30-40	8-15
VnC*:											
Vanocker--------	0-2	Channery loam----	ML, CL, SM, SC	A-4, A-6, A-7	0-10	60-80	55-75	50-70	45-70	30-45	7-20
	2-13	Gravelly silty clay loam, very channery clay loam, very channery clay loam.	CL, SC, GC	A-6, A-7	5-15	60-80	50-70	45-65	40-60	30-45	10-20
	13-60	Very gravelly silt loam, very gravelly loam, very channery loam.	CL, GC, ML, GM	A-6, A-4	5-25	50-70	40-60	40-55	35-55	30-40	7-15
Paunsaugunt-----	0-6	Gravelly loam----	GC	A-2, A-6	0-5	50-65	50-65	35-55	25-50	20-35	10-15
	6-11	Very gravelly loam, very cobbly loam.	GM-GC, GM	A-1, A-2, A-4	5-50	40-65	40-65	40-65	20-45	15-25	NP-10
	11-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
VoG*:											
Vanocker--------	0-2	Channery loam----	ML, CL, SM, SC	A-4, A-6, A-7	0-10	60-80	55-75	50-70	45-70	30-45	7-20
	2-13	Gravelly silty clay loam, very channery clay loam, very channery clay loam.	CL, SC, GC	A-6, A-7	5-15	60-80	50-70	45-65	40-60	30-45	10-20
	13-60	Very gravelly silt loam, very gravelly loam, very channery silt loam.	CL, GC, ML, GM	A-6, A-4	5-25	50-70	40-60	40-55	35-55	30-40	7-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
VoG*:											
Sawdust---------	0-4	Channery loam----	ML, CL	A-4, A-6, A-7	15-50	70-100	60-90	55-80	50-70	30-45	7-20
	4-8	Very channery loam, very channery silt loam.	CL, SC, GC	A-4, A-6, A-7	30-60	60-80	50-75	45-60	35-55	30-45	8-20
	8-60	Extremely channery sandy loam, extremely channery loam, very channery loam.	CL, SC, CL-ML, SM-SC	A-2, A-4, A-6	40-70	45-70	35-70	30-60	25-55	25-40	7-15
Rock outcrop.											
VpC*:											
Virkula---------	0-13	Loam-------------	ML, CL	A-4, A-6	0	90-100	75-100	60-95	50-85	30-40	5-15
	13-45	Clay loam, silty clay loam, loam.	CL, CH, ML, CH	A-7, A-6	0-5	90-100	85-100	85-100	80-95	35-55	11-25
	45-60	Channery silty clay loam, very channery silty clay loam, clay loam.	CL, SC	A-6, A-7, A-2, A-4	0-15	90-100	40-85	35-75	25-60	30-50	8-25
VpC*:											
Pactola---------	0-11	Channery loam, channery silt loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-25	60-95	50-90	40-70	35-55	25-40	5-15
	11-18	Channery loam, very channery clay loam, very channery silty clay loam.	CL, SC, GC	A-4, A-6	35-55	60-95	45-90	45-75	40-65	28-40	8-20
	18-42	Extremely channery clay loam, very channery clay loam, extremely channery silty clay loam.	ML, CL, SC, SM	A-4, A-6, A-7	35-75	60-90	45-75	40-70	35-60	30-45	5-20
	42-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WtB-------------- Winetti	0-5	Cobbly loam------	SM, SM-SC, ML, CL-ML	A-4	20-30	75-85	70-80	50-70	40-60	20-30	NP-10
	5-30	Very gravelly sandy loam, sandy loam, loamy sand.	SM	A-2, A-1	0	70-100	40-90	35-65	15-35	15-25	NP-5
	30-60	Very cobbly sandy loam.	GM, SM, GP-GM, SP-SM	A-1	0-40	35-60	25-50	15-30	5-15	---	NP
ZcC*:											
Zigweid---------	0-4	Clay loam--------	CL	A-6	0	75-100	75-100	70-85	60-70	35-40	15-20
	4-60	Loam, clay loam	CL	A-6	0	75-100	75-100	70-85	60-70	25-40	10-20

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ZcC*:											
Canyon----------	0-4	Loam-------------	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	4-18	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	18-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
ZnD*:											
Zigweid---------	0-4	Clay loam--------	CL	A-6	0	75-100	75-100	70-85	60-70	35-40	15-20
	4-60	Loam, clay loam	CL	A-6	0	75-100	75-100	70-85	60-70	25-40	10-20
Nihill----------	0-7	Gravelly loam----	GM, SM, ML	A-2, A-4	0-5	60-85	50-75	35-65	30-60	25-35	NP-10
	7-60	Very gravelly loam, very gravelly sandy loam, very gravelly clay loam.	GM-GC, GC, GP-GC	A-2, A-1	0-15	30-60	25-50	15-40	10-35	25-40	5-15

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
ApA-------------- Arvada Variant	0-2	15-30	1.10-1.25	0.6-2.0	0.16-0.18	7.4-8.4	<4	Low--------	0.24	3	7	1-2
	2-10	35-60	1.15-1.30	<0.06	0.08-0.13	7.4-9.0	8-16	High-------	0.37			
	10-36	27-40	1.25-1.45	0.06-0.6	0.11-0.15	7.4-9.0	8-16	Moderate	0.37			
	36-60	20-40	1.30-1.50	0.06-0.6	0.11-0.15	7.4-9.0	8-16	Moderate	0.37			
AsA*:												
Arvada-----------	0-3	10-20	1.25-1.35	2.0-6.0	0.13-0.15	6.6-9.0	<4	Low--------	0.24	3	3	.5-1
	3-12	35-60	1.20-1.40	<0.06	0.07-0.09	>7.8	<2	High-------	0.32			
	12-60	28-45	1.20-1.40	0.06-0.2	0.09-0.11	>7.8	<4	High-------	0.32			
Slickspots.												
BdA-------------- Barnum	0-2	10-20	1.15-1.25	0.6-2.0	0.15-0.17	7.4-9.0	2-8	Low--------	0.28	5	5	2-3
	2-60	18-35	1.25-1.40	0.6-2.0	0.16-0.18	7.4-9.0	2-8	Moderate	0.28			
BeB*:												
Barnum-----------	0-2	10-20	1.15-1.25	0.6-2.0	0.15-0.17	7.4-9.0	2-8	Low--------	0.28	5	5	2-3
	2-60	18-35	1.25-1.40	0.6-2.0	0.16-0.18	7.4-9.0	2-8	Moderate	0.28			
Winetti----------	0-5	10-20	1.45-1.50	2.0-6.0	0.08-0.10	7.4-8.4	<2	Low--------	0.28	3	8	2-4
	5-30	5-15	1.40-1.45	2.0-6.0	0.06-0.11	7.4-8.4	<2	Low--------	0.15			
	30-60	5-10	1.35-1.40	2.0-6.0	0.04-0.08	7.4-8.4	<2	Low--------	0.10			
BrA, BrB--------- Bullflat	0-6	16-26	1.15-1.25	0.6-2.0	0.19-0.21	5.6-7.3	<2	Low--------	0.32	5	6	3-5
	6-21	20-34	1.20-1.30	0.6-2.0	0.16-0.20	6.1-7.3	<2	Moderate	0.32			
	21-28	18-34	1.20-1.30	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.32			
	28-60	15-34	1.30-1.50	0.6-2.0	0.07-0.10	7.4-8.4	<2	Low--------	0.32			
BsB*:												
Bullflat---------	0-6	16-26	1.15-1.25	0.6-2.0	0.19-0.21	5.6-7.3	<2	Low--------	0.32	5	6	3-5
	6-21	20-34	1.20-1.30	0.6-2.0	0.16-0.20	6.1-7.3	<2	Moderate	0.32			
	21-28	18-34	1.20-1.30	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.32			
	28-60	15-34	1.30-1.50	0.6-2.0	0.07-0.10	7.4-8.4	<2	Low--------	0.32			
Cordeston--------	0-10	18-27	1.10-1.20	0.6-2.0	0.17-0.19	6.6-7.8	<2	Low--------	0.32	5	5	4-6
	10-45	18-27	1.20-1.30	0.6-2.0	0.13-0.17	6.6-7.8	<2	Moderate	0.32			
	45-60	10-30	1.30-1.40	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low--------	0.32			
BtE*:												
Buska------------	0-12	5-15	1.25-1.35	0.6-2.0	0.17-0.20	5.6-7.3	<2	Low--------	0.32	3	5	2-4
	12-15	7-20	1.30-1.40	0.6-2.0	0.09-0.13	5.6-7.3	<2	Moderate	0.24			
	15-41	18-25	1.35-1.60	0.6-2.0	0.05-0.9	5.6-7.8	<2	Low--------	0.24			
	41-60	---	---	---	---	---	---	-----------	----			
Mocmont----------	0-12	10-20	1.40-1.60	2.0-6.0	0.08-0.12	5.6-7.3	<2	Low--------	0.28	3	5	1-3
	12-50	20-35	1.40-1.60	0.6-2.0	0.06-0.10	5.1-7.3	<2	Moderate	0.20			
	50-60	5-15	1.45-1.70	2.0-6.0	0.04-0.06	5.6-7.3	<2	Low--------	0.15			
Rock outcrop.												
BuE*:												
Buska------------	0-12	5-15	1.25-1.35	0.6-2.0	0.17-0.20	5.6-7.3	<2	Low--------	0.32	3	5	2-4
	12-15	7-20	1.30-1.40	0.6-2.0	0.09-0.13	5.6-7.3	<2	Moderate	0.24			
	15-41	18-25	1.35-1.60	0.6-2.0	0.05-0.9	5.6-7.8	<2	Low--------	0.24			
	41-60	---	---	---	---	---	---	-----------	----			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
BuE*:												
Rock outcrop.												
BvC*:												
Buska-----------	0-12	5-15	1.25-1.35	0.6-2.0	0.17-0.20	5.6-7.3	<2	Low--------	0.32	3	5	2-4
	12-15	7-20	1.30-1.40	0.6-2.0	0.09-0.13	5.6-7.3	<2	Moderate	0.24			
	15-41	18-25	1.35-1.60	0.6-2.0	0.05-0.9	5.6-7.8	<2	Low--------	0.24			
	41-60	---	---	---	---	---	---	-----------	----			
Virkula---------	0-13	15-26	1.20-1.30	0.6-2.0	0.16-0.18	5.1-6.5	<2	Low--------	0.37	5	6	2-4
	13-45	20-34	1.20-1.40	0.2-0.6	0.12-0.17	5.1-6.5	<2	Moderate	0.37			
	45-60	18-30	1.30-1.50	0.2-2.0	0.10-0.15	5.6-7.3	<2	Moderate	0.37			
BwE*:												
Butche----------	0-4	15-25	1.40-1.65	0.6-6.0	0.10-0.12	6.1-7.3	<2	Low--------	0.24	2	8	1-3
	4-10	15-25	1.40-1.65	0.6-2.0	0.09-0.13	6.1-7.8	<2	Low--------	0.24			
	10-60	---	---	---	---	---	---	-----------	----			
Rock outcrop.												
CcE*:												
Canyon----------	0-4	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.32	2	4L	.5-1
	4-18	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.43			
	18-60	---	---	---	---	---	---	-----------	----			
Bridget---------	0-9	10-18	1.20-1.45	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low--------	0.32	5	3	2-4
	9-17	13-18	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.43			
	17-60	13-18	1.20-1.45	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.43			
CdF*:												
Canyon----------	0-4	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.32	2	4L	.5-1
	4-18	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.43			
	18-60	---	---	---	---	---	---	-----------	----			
Rock outcrop.												
CkC*:												
Citadel---------	0-10	10-20	1.20-1.35	0.6-2.0	0.16-0.18	5.1-7.3	<2	Low--------	0.37	5	5	2-4
	10-34	35-45	1.40-1.65	0.06-0.6	0.11-0.17	5.1-7.3	<2	High-------	0.37			
	34-42	20-35	1.45-1.75	0.2-2.0	0.11-0.19	7.4-8.4	<2	Moderate	0.37			
	42-60	15-30	1.45-1.75	0.2-2.0	0.10-0.18	6.6-8.4	<2	Moderate	0.28			
Vanocker--------	0-2	20-27	1.25-1.40	0.6-2.0	0.10-0.12	5.6-7.3	<2	Moderate	0.17	5	8	5-10
	2-13	25-34	1.40-1.60	0.6-2.0	0.09-0.11	5.6-7.8	<2	Moderate	0.24			
	13-60	25-34	1.45-1.70	0.6-2.0	0.09-0.11	7.4-8.4	<2	Moderate	0.24			
CoA--------------	0-10	15-25	1.35-1.45	0.6-2.0	0.14-0.18	7.4-8.4	<2	Low--------	0.28	5	5	2-4
Colombo	10-60	18-35	1.35-1.45	0.6-2.0	0.14-0.16	7.4-9.0	<2	Low--------	0.28			
CpA*:												
Colombo---------	0-10	15-25	1.35-1.45	0.6-2.0	0.14-0.18	7.4-8.4	<2	Low--------	0.28	5	5	2-4
	10-60	18-35	1.35-1.45	0.6-2.0	0.14-0.16	7.4-9.0	<2	Low--------	0.28			
Urban land.												
CvB--------------	0-10	18-27	1.10-1.20	0.6-2.0	0.17-0.19	6.6-7.8	<2	Low--------	0.32	5	5	4-6
Cordeston	10-45	18-27	1.20-1.30	0.6-2.0	0.13-0.17	6.6-7.8	<2	Moderate	0.32			
	45-60	10-30	1.30-1.40	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low--------	0.32			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
CwB*:												
Cordeston-------	0-10	18-27	1.10-1.20	0.6-2.0	0.17-0.19	6.6-7.8	<2	Low--------	0.32	5	5	4-6
	10-45	18-27	1.20-1.30	0.6-2.0	0.13-0.17	6.6-7.8	<2	Moderate	0.32			
	45-60	10-30	1.30-1.40	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low--------	0.32			
Marshbrook------	0-25	20-30	1.25-1.30	0.6-2.0	0.19-0.21	6.1-7.8	<2	Low--------	0.24	5	6	5-15
	25-41	20-35	1.35-1.40	0.2-0.6	0.17-0.19	6.1-7.8	<2	Moderate	0.32			
	41-60	10-27	1.40-1.55	0.6-6.0	0.08-0.13	6.6-8.4	<2	Low--------	0.20			
CxC*:												
Cordeston-------	0-10	18-27	1.10-1.20	0.6-2.0	0.17-0.19	6.6-7.8	<2	Low--------	0.32	5	5	4-6
	10-32	18-27	1.20-1.30	0.6-2.0	0.13-0.17	6.6-7.8	<2	Moderate	0.32			
	32-60	10-30	1.30-1.40	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low--------	0.32			
Winetti---------	0-5	10-20	1.45-1.50	2.0-6.0	0.08-0.10	7.4-8.4	<2	Low--------	0.05	3	8	2-4
	5-30	5-15	1.40-1.45	2.0-6.0	0.06-0.11	7.4-8.4	<2	Low--------	0.15			
	30-60	5-10	1.35-1.40	2.0-6.0	0.04-0.08	7.4-8.4	<2	Low--------	0.10			
DgB*:												
Demar-----------	0-5	27-30	1.15-1.30	0.6-2.0	0.16-0.20	5.1-7.3	<2	Moderate	0.37	3	6	.5-3
	5-17	35-60	1.25-1.40	<0.06	0.08-0.17	4.5-7.3	<2	High-------	0.37			
	17-35	35-60	1.25-1.40	<0.06	0.08-0.17	<5.1	8-16	High-------	0.37			
	35-60	35-60	1.25-1.40	<0.06	0.08-0.17	<5.1	8-16	High-------	0.37			
Grummit---------	0-4	40-65	1.15-1.30	0.2-0.6	0.08-0.17	3.6-5.5	<2	High-------	0.28	2	4	1-2
	4-16	40-65	1.10-1.25	0.6-2.0	0.08-0.17	3.6-5.5	<2	High-------	0.28			
	16-60	---	---	---	---	---	---	-----------	----			
Slickspots.												
GbA-------------- Glenberg	0-5	8-20	1.40-1.50	2.0-6.0	0.11-0.14	7.4-8.4	<2	Low--------	0.24	5	3	2-3
	5-60	8-15	1.50-1.60	2.0-6.0	0.07-0.12	7.4-8.4	<2	Low--------	0.10			
GrD*:												
Grummit---------	0-4	40-65	1.15-1.30	0.2-0.6	0.08-0.17	3.6-5.5	<2	High-------	0.28	2	4	1-2
	4-16	40-65	1.10-1.25	0.6-2.0	0.08-0.17	3.6-5.5	<2	High-------	0.28			
	16-60	---	---	---	---	---	---	-----------	----			
Rock outcrop.												
GrF*:												
Grummit---------	0-4	40-65	1.15-1.30	0.2-0.6	0.08-0.17	3.6-5.5	<2	High-------	0.28	2	4	1-2
	4-16	40-65	1.10-1.25	0.6-2.0	0.08-0.17	3.6-5.5	<2	High-------	0.28			
	16-60	---	---	---	---	---	---	-----------	----			
Rock outcrop.												
GuC*:												
Gurney----------	0-5	16-25	1.15-1.25	0.6-2.0	0.19-0.21	5.6-7.3	<2	Low--------	0.32	4	6	3-5
	5-16	20-34	1.15-1.25	0.6-2.0	0.16-0.20	6.1-7.3	<2	Moderate	0.32			
	16-28	18-30	1.25-1.35	0.6-2.0	0.15-0.17	7.4-8.4	<2	Low--------	0.32			
	28-60	---	---	---	---	---	---	-----------	----			
Butche----------	0-4	15-25	1.40-1.65	0.6-6.0	0.10-0.12	6.1-7.3	<2	Low--------	0.24	2	8	1-3
	4-10	15-25	1.40-1.65	0.6-2.0	0.09-0.13	6.1-7.8	<2	Low--------	0.24			
	10-60	---	---	---	---	---	---	-----------	----			
GvD*:												
Gypnevee--------	0-8	10-18	1.05-1.15	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low--------	0.49	4	6	1-2
	8-41	10-18	1.20-1.30	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low--------	0.55			
	41-60	---	---	---	---	---	---	-----------	----			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
GvD*:												
Rekop-----------	0-4	15-25	1.15-1.25	0.6-2.0	0.16-0.18	7.4-9.0	2-4	Low--------	0.37	2	5	1-2
	4-12	15-25	1.35-1.45	0.6-2.0	0.12-0.18	7.4-9.0	2-4	Low--------	0.20			
	12-60	---	---	---	---	---	---	----------	----			
Rock outcrop.												
GyD*:												
Gypnevee--------	0-8	10-18	1.05-1.15	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low--------	0.49	4	6	1-2
	8-41	10-18	1.20-1.30	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low--------	0.55			
	41-60	---	---	---	---	---	---	----------	----			
Rock outcrop.												
Urban land.												
HaA-------------- Haverson	0-4	10-26	1.20-1.35	0.6-2.0	0.14-0.18	6.6-8.4	<2	Low--------	0.28	5	4L	1-3
	4-60	18-35	1.30-1.45	0.6-2.0	0.14-0.18	7.4-9.0	2-4	Low--------	0.28			
HeE-------------- Heely	0-6	15-26	1.30-1.50	0.6-2.0	0.12-0.15	5.6-7.3	<2	Low--------	0.28	2	8	2-5
	6-17	10-30	1.35-1.60	0.6-2.0	0.10-0.14	5.6-7.3	<2	Low--------	0.28			
	17-27	15-27	1.40-1.60	0.6-2.0	0.09-0.13	5.6-7.3	<2	Low--------	0.28			
	27-60	---	---	---	---	---	---	----------	----			
HfC*:												
Heely-----------	0-6	15-26	1.30-1.50	0.6-2.0	0.12-0.15	5.6-7.3	<2	Low--------	0.28	2	8	2-5
	6-17	10-30	1.35-1.60	0.6-2.0	0.10-0.14	5.6-7.3	<2	Low--------	0.28			
	17-27	15-27	1.40-1.60	0.6-2.0	0.09-0.13	5.6-7.3	<2	Low--------	0.28			
	27-60	---	---	---	---	---	---	----------	----			
Cordeston-------	0-10	18-27	1.10-1.20	0.6-2.0	0.17-0.19	6.6-7.8	<2	Low--------	0.32	5	5	4-6
	10-45	18-27	1.20-1.30	0.6-2.0	0.13-0.17	6.6-7.8	<2	Moderate	0.32			
	45-60	10-30	1.30-1.40	0.6-2.0	0.13-0.17	6.6-7.8	<2	Low--------	0.32			
HgB, HgD--------- Hilger	0-5	15-27	1.25-1.40	0.6-2.0	0.11-0.13	6.6-7.8	<2	Low--------	0.17	3	6	2-6
	5-18	25-35	1.30-1.45	0.6-2.0	0.06-0.07	6.6-8.4	<2	Moderate	0.20			
	18-26	15-27	1.30-1.45	0.6-2.0	0.05-0.06	7.9-8.4	<2	Low--------	0.10			
	26-60	15-27	1.35-1.50	0.6-2.0	0.05-0.06	7.9-8.4	<2	Low--------	0.10			
HmE*:												
Hilger----------	0-6	15-27	1.25-1.40	0.6-2.0	0.11-0.13	6.6-7.8	<2	Low--------	0.17	3	6	2-6
	6-18	25-35	1.30-1.45	0.6-2.0	0.06-0.07	6.6-8.4	<2	Moderate	0.20			
	18-28	15-27	1.30-1.45	0.6-2.0	0.05-0.06	7.9-8.4	<2	Low--------	0.10			
	28-60	15-27	1.35-1.50	0.6-2.0	0.05-0.06	7.9-8.4	<2	Low--------	0.10			
Metre-----------	0-5	55-65	1.15-1.30	<0.06	0.10-0.14	6.6-8.4	<2	Very high	0.37	4	4	2-4
	5-26	60-70	1.20-1.35	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	26-36	55-70	1.25-1.40	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	36-60	---	---	---	---	---	---	----------	----			
HnB*:												
Hilger----------	0-5	15-27	1.25-1.40	0.6-2.0	0.11-0.13	6.6-7.8	<2	Low--------	0.17	3	6	2-6
	5-18	25-35	1.30-1.45	0.6-2.0	0.06-0.07	6.6-8.4	<2	Moderate	0.20			
	18-26	15-27	1.30-1.45	0.6-2.0	0.05-0.06	7.9-8.4	<2	Low--------	0.10			
	26-60	15-27	1.35-1.50	0.6-2.0	0.05-0.06	7.9-8.4	<2	Low--------	0.10			
Urban land.												

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
HoD*:												
Hilger----------	0-5	15-27	1.25-1.40	0.6-2.0	0.11-0.13	6.6-7.8	<2	Low-------	0.17	3	6	2-6
	5-18	25-35	1.30-1.45	0.6-2.0	0.06-0.07	6.6-8.4	<2	Moderate	0.20			
	18-26	15-27	1.30-1.45	0.6-2.0	0.05-0.06	7.9-8.4	<2	Low-------	0.10			
	26-60	15-27	1.35-1.50	0.6-2.0	0.05-0.06	7.9-8.4	<2	Low-------	0.10			
Virkula---------	0-4	15-26	1.10-1.25	0.6-2.0	0.17-0.20	5.1-6.5	<2	Low-------	0.37	5	6	2-4
	4-45	20-34	1.20-1.40	0.2-0.6	0.12-0.17	5.1-6.5	<2	Moderate	0.37			
	45-60	18-30	1.30-1.50	0.2-2.0	0.10-0.15	5.6-7.3	<2	Moderate	0.37			
HtG*:												
Hopdraw---------	0-3	3-10	1.30-1.50	6.0-20	0.08-0.10	6.6-8.4	<2	Low-------	0.10	5	8	.5-1
	3-44	3-10	1.50-1.75	6.0-20	0.06-0.08	7.4-9.0	<2	Low-------	0.10			
	44-60	---	---	---	---	---	---	----------	----			
Sawdust---------	0-4	20-26	1.35-1.50	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low-------	0.17	5	8	2-4
	4-8	20-26	1.50-1.80	0.6-2.0	0.12-0.14	7.4-8.4	<2	Low-------	0.24			
	8-60	18-26	1.50-1.80	0.6-2.0	0.10-0.12	7.4-8.4	<2	Low-------	0.24			
Rock outcrop.												
JhD*:												
Judy------------	0-6	20-27	1.25-1.30	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low-------	0.37	4	5	3-5
	6-24	35-50	1.25-1.30	0.06-0.2	0.12-0.16	6.6-8.4	<2	High------	0.37			
	24-60	---	---	---	---	---	---	----------	----			
Heath-----------	0-7	20-27	1.30-1.40	0.6-2.0	0.16-0.18	6.1-7.8	<2	Low-------	0.32	5	6	2-5
	7-36	35-50	1.20-1.30	0.06-0.2	0.14-0.18	6.1-7.8	<2	High------	0.32			
	36-60	27-40	1.25-1.40	0.2-0.6	0.12-0.16	7.4-8.4	<2	Moderate	0.28			
Paunsaugunt Variant--------	0-4	18-27	1.25-1.35	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low-------	0.20	2	6	1-4
	4-11	18-27	1.35-1.55	0.6-6.0	0.08-0.10	6.6-8.4	<2	Low-------	0.20			
	11-60	---	---	---	---	---	---	----------	----			
MhA-------------- Marshbrook	0-25	20-30	1.25-1.30	0.6-2.0	0.19-0.21	6.1-7.8	<2	Low-------	0.24	5	6	5-15
	25-41	20-35	1.35-1.40	0.2-0.6	0.17-0.19	6.1-7.8	<2	Moderate	0.32			
	41-60	10-27	1.40-1.55	0.6-6.0	0.08-0.13	6.6-8.4	<2	Low-------	0.20			
MnC*:												
Metre-----------	0-5	55-65	1.15-1.30	<0.06	0.10-0.14	6.6-8.4	<2	Very high	0.37	4	4	2-4
	5-26	60-70	1.20-1.35	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	26-36	60-70	1.25-1.40	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	36-60	---	---	---	---	---	---	----------	----			
Norrest---------	0-4	27-34	1.15-1.35	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37	4	4L	2-4
	4-32	35-45	1.20-1.40	0.2-0.6	0.11-0.17	7.4-8.4	<2	High------	0.37			
	32-60	---	---	---	---	---	---	----------	----			
MsC-------------- Mocmont	0-12	10-20	1.40-1.60	2.0-6.0	0.08-0.12	5.6-7.3	<2	Low-------	0.28	3	5	1-3
	12-50	20-35	1.40-1.60	0.6-2.0	0.06-0.10	5.1-7.3	<2	Moderate	0.20			
	50-60	5-15	1.45-1.70	2.0-6.0	0.04-0.06	5.6-7.3	<2	Low-------	0.15			
MtE*:												
Mocmont---------	0-12	10-20	1.40-1.60	2.0-6.0	0.08-0.12	5.6-7.3	<2	Low-------	0.28	3	5	1-3
	12-50	20-35	1.40-1.60	0.6-2.0	0.06-0.10	5.1-7.3	<2	Moderate	0.20			
	50-60	5-15	1.45-1.70	2.0-6.0	0.04-0.06	5.6-7.3	<2	Low-------	0.15			
Rock outcrop.												

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
NaC------------- Nevee	0-8	10-18	1.30-1.50	0.6-2.0	0.10-0.12	6.6-8.4	<2	Low--------	0.24	5	8	1-3
	8-60	10-18	1.30-1.45	0.6-2.0	0.10-0.14	7.4-9.0	2-4	Low--------	0.43			
NbC------------- Nevee	0-8	10-18	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low--------	0.32	5	4L	1-3
	8-60	10-18	1.35-1.45	0.6-2.0	0.12-0.20	7.4-9.0	2-4	Low--------	0.43			
NcE*:												
Nevee-----------	0-8	10-18	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low--------	0.32	5	4L	1-3
	8-60	10-18	1.35-1.45	0.6-2.0	0.12-0.20	7.4-9.0	2-4	Low--------	0.43			
Gullied land.												
NfE*:												
Nihill----------	0-7	10-27	1.15-1.25	0.6-2.0	0.12-0.16	7.4-8.4	<2	Low--------	0.10	5	5	.5-1
	7-60	18-30	1.30-1.40	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low--------	0.05			
Zigweid---------	0-4	27-35	1.15-1.25	0.6-2.0	0.18-0.21	7.4-8.4	<2	Moderate	0.32	5	6	1-2
	4-60	18-35	1.25-1.40	0.6-2.0	0.16-0.21	7.9-9.0	<2	Moderate	0.43			
NnE*:												
Norrest---------	0-4	27-34	1.10-1.30	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.28	4	8	2-4
	4-8	35-45	1.20-1.40	0.2-0.6	0.08-0.14	7.4-8.4	<2	High-------	0.28			
	8-32	27-45	1.20-1.40	0.2-0.6	0.11-0.17	7.4-8.4	<2	High-------	0.37			
	32-60	---	---	---	---	---	---	-----------	----			
Fairburn--------	0-3	27-35	1.20-1.30	0.6-2.0	0.18-0.21	6.6-8.4	<2	Moderate	0.28	2	8	1-3
	3-18	25-35	1.20-1.35	0.2-2.0	0.17-0.20	7.4-9.0	<2	Moderate	0.43			
	18-60	---	---	---	---	---	---	-----------	----			
Metre-----------	0-5	55-65	1.15-1.30	<0.06	0.10-0.14	6.6-8.4	<2	Very high	0.37	4	4	2-4
	5-26	55-70	1.20-1.35	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	26-36	55-70	1.25-1.40	<0.06	0.08-0.12	7.4-8.4	<2	Very high	0.37			
	36-60	---	---	---	---	---	---	-----------	----			
PaE*:												
Pactola---------	0-11	10-25	1.30-1.50	0.6-2.0	0.12-0.15	5.6-6.5	<2	Low--------	0.24	3	8	2-5
	11-18	20-30	1.50-1.75	0.6-2.0	0.09-0.13	5.6-6.5	<2	Moderate	0.24			
	18-42	27-35	1.55-1.80	0.6-2.0	0.05-0.08	5.6-6.5	<2	Moderate	0.24			
	42-60	---	---	---	---	---	---	-----------	----			
Virkula---------	0-13	15-26	1.20-1.30	0.6-2.0	0.16-0.18	5.1-6.5	<2	Low--------	0.37	5	6	2-4
	13-45	20-34	1.20-1.40	0.2-0.6	0.12-0.17	5.1-6.5	<2	Moderate	0.37			
	45-60	18-30	1.30-1.50	0.2-2.0	0.10-0.15	5.6-7.3	<2	Moderate	0.37			
Rock outcrop.												
PbD*:												
Paunsaugunt-----	0-6	18-25	1.25-1.30	0.6-6.0	0.13-0.16	7.4-8.4	<2	Moderate	0.20	2	8	2-4
	6-11	10-18	1.35-1.40	2.0-6.0	0.06-0.08	7.4-8.4	<2	Low--------	0.17			
	11-60	---	---	---	---	---	---	-----------	----			
Gurney----------	0-5	16-25	1.15-1.25	0.6-2.0	0.19-0.21	5.6-7.3	<2	Low--------	0.32	4	6	3-5
	5-16	20-34	1.15-1.25	0.6-2.0	0.16-0.20	6.1-7.3	<2	Moderate	0.32			
	16-28	18-30	1.25-1.35	0.6-2.0	0.15-0.17	7.4-8.4	<2	Low--------	0.32			
	28-60	---	---	---	---	---	---	-----------	----			
PcD*:												
Paunsaugunt-----	0-6	18-25	1.25-1.30	0.6-6.0	0.13-0.16	7.4-8.4	<2	Moderate	0.20	2	8	2-4
	6-11	10-18	1.35-1.40	2.0-6.0	0.06-0.08	7.4-8.4	<2	Low--------	0.17			
	11-60	---	---	---	---	---	---	-----------	----			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
PcD*:												
Rock outcrop.												
PgC*:												
Pierre----------	0-4	50-70	1.10-1.25	<0.06	0.08-0.12	6.1-7.8	<2	Very high	0.37	4	4	1-3
	4-16	60-70	1.10-1.25	<0.06	0.08-0.12	6.6-8.4	<2	Very high	0.37			
	16-32	60-70	1.10-1.35	<0.06	0.08-0.12	7.4-8.4	2-8	Very high	0.37			
	32-60	---	---	---	---	---	---	----------	----			
Grummit---------	0-4	40-65	1.15-1.30	0.2-0.6	0.08-0.17	3.6-5.5	<2	High------	0.28	2	4	1-2
	4-16	40-65	1.10-1.25	0.6-2.0	0.08-0.17	3.6-5.5	<2	High------	0.28			
	16-60	---	---	---	---	---	---	----------	----			
Pt*.												
Pits												
ReC*:												
Redbird---------	0-7	10-25	1.20-1.35	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low-------	0.32	2	5	2-5
	7-20	27-35	1.40-1.60	0.6-2.0	0.09-0.13	6.6-7.8	<2	Moderate	0.24			
	20-24	20-30	1.45-1.70	0.6-2.0	0.09-0.13	7.4-8.4	<2	Moderate	0.24			
	24-60	20-30	1.45-1.70	0.6-2.0	0.09-0.13	7.4-8.4	<2	Low-------	0.24			
Heath-----------	0-7	20-27	1.30-1.40	0.6-2.0	0.16-0.18	6.1-7.8	<2	Low-------	0.32	5	6	2-5
	7-36	35-50	1.20-1.30	0.06-0.2	0.14-0.18	6.1-7.8	<2	High------	0.32			
	36-60	27-40	1.25-1.40	0.2-0.6	0.12-0.16	7.4-8.4	<2	Moderate	0.28			
RfE*:												
Rekop-----------	0-4	15-25	1.15-1.25	0.6-2.0	0.16-0.18	7.4-9.0	2-4	Low-------	0.37	2	5	1-2
	4-12	15-25	1.35-1.45	0.6-2.0	0.12-0.18	7.4-9.0	2-4	Low-------	0.20			
	12-60	---	---	---	---	---	---	----------	----			
Gypnevee--------	0-8	10-18	1.05-1.15	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low-------	0.49	4	6	1-2
	8-41	10-18	1.20-1.30	0.6-2.0	0.19-0.21	7.4-8.4	<2	Low-------	0.55			
	41-60	---	---	---	---	---	---	----------	----			
Rock outcrop.												
RgG*:												
Rock outcrop.												
Buska-----------	0-12	5-15	1.25-1.35	0.6-2.0	0.17-0.20	5.6-7.3	<2	Low-------	0.32	3	5	2-4
	12-15	7-20	1.30-1.40	0.6-2.0	0.09-0.13	5.6-7.3	<2	Moderate	0.24			
	15-41	18-25	1.35-1.60	0.6-2.0	0.05-0.9	5.6-7.8	<2	Low-------	0.24			
	41-60	---	---	---	---	---	---	----------	----			
RhD*:												
Rock outcrop.												
Butche----------	0-4	15-25	1.40-1.65	0.6-6.0	0.10-0.12	6.1-7.3	<2	Low-------	0.24	2	8	1-3
	4-10	15-25	1.40-1.65	0.6-2.0	0.09-0.13	6.1-7.8	<2	Low-------	0.24			
	10-60	---	---	---	---	---	---	----------	----			
RkG*:												
Rock outcrop.												
Mocmont---------	0-12	10-20	1.40-1.60	2.0-6.0	0.08-0.12	5.6-7.3	<2	Low-------	0.28	3	5	1-3
	12-50	20-35	1.40-1.60	0.6-2.0	0.06-0.10	5.1-7.3	<2	Moderate	0.20			
	50-60	5-15	1.45-1.70	2.0-6.0	0.04-0.06	5.6-7.3	<2	Low-------	0.15			
RlG*:												
Rock outcrop.												

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
RlG*:												
Pactola---------	0-11	10-25	1.30-1.50	0.6-2.0	0.12-0.15	5.6-6.5	<2	Low--------	0.24	3	8	2-5
	11-18	20-30	1.50-1.75	0.6-2.0	0.09-0.13	5.6-6.5	<2	Moderate	0.24			
	18-42	27-35	1.55-1.80	0.6-2.0	0.05-0.08	5.6-6.5	<2	Moderate	0.24			
	42-60	---	---	---	---	---	---	----------	----			
RmG*:												
Rock outcrop.												
Rekop-----------	0-4	15-25	1.15-1.25	0.6-2.0	0.16-0.18	7.4-9.0	2-4	Low--------	0.37	2	5	1-2
	4-12	15-25	1.35-1.45	0.6-2.0	0.12-0.18	7.4-9.0	2-4	Low--------	0.20			
	12-60	---	---	---	---	---	---	----------	----			
RnG*:												
Rock outcrop.												
Sawdust---------	0-4	20-26	1.35-1.50	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low--------	0.17	5	8	2-4
	4-8	20-26	1.50-1.80	0.6-2.0	0.12-0.14	7.4-8.4	<2	Low--------	0.24			
	8-60	18-26	1.50-1.80	0.6-2.0	0.10-0.12	7.4-8.4	<2	Low--------	0.24			
RpC*:												
Rockoa----------	0-6	10-18	1.30-1.45	0.6-6.0	0.08-0.12	5.6-7.3	<2	Low--------	0.15	5	8	1-4
	6-22	18-30	1.35-1.60	0.6-2.0	0.14-0.18	5.6-7.3	<2	Low--------	0.24			
	22-60	15-25	1.60-1.70	0.6-6.0	0.13-0.17	5.6-7.3	<2	Low--------	0.24			
Lakoa-----------	0-5	10-20	1.15-1.25	0.6-2.0	0.15-0.20	5.1-7.3	<2	Low--------	0.32	5	5	1-3
	5-11	15-35	1.20-1.30	0.6-2.0	0.15-0.20	5.1-6.5	<2	Moderate	0.32			
	11-22	25-35	1.25-1.40	0.6-2.0	0.16-0.20	5.6-7.3	<2	Moderate	0.32			
	22-33	20-30	1.25-1.40	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.32			
	33-60	20-30	1.30-1.55	0.6-2.0	0.13-0.17	5.6-8.4	<2	Moderate	0.24			
RrE*:												
Rockoa----------	0-6	10-18	1.30-1.45	0.6-6.0	0.08-0.12	5.6-7.3	<2	Low--------	0.15	5	8	1-4
	6-22	18-30	1.35-1.60	0.6-2.0	0.14-0.18	5.6-7.3	<2	Low--------	0.24			
	22-60	15-25	1.60-1.70	0.6-6.0	0.13-0.17	5.6-7.3	<2	Low--------	0.24			
Lakoa-----------	0-5	10-20	1.15-1.25	0.6-2.0	0.15-0.20	5.1-7.3	<2	Low--------	0.32	5	5	1-3
	5-11	15-35	1.20-1.30	0.6-2.0	0.15-0.20	5.1-6.5	<2	Moderate	0.32			
	11-22	25-35	1.25-1.40	0.6-2.0	0.16-0.20	5.6-7.3	<2	Moderate	0.32			
	22-33	20-30	1.25-1.40	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.32			
	33-60	20-30	1.30-1.55	0.6-2.0	0.13-0.17	5.6-8.4	<2	Moderate	0.24			
Rock outcrop.												
RsF*:												
Rockoa----------	0-6	10-18	1.30-1.45	0.6-6.0	0.08-0.12	5.6-7.3	<2	Low--------	0.15	5	8	1-4
	6-22	18-30	1.35-1.60	0.6-2.0	0.14-0.18	5.6-7.3	<2	Low--------	0.24			
	22-60	15-25	1.60-1.70	0.6-6.0	0.13-0.17	5.6-7.3	<2	Low--------	0.24			
Rock outcrop.												
RtD*:												
Rockoa----------	0-6	10-18	1.30-1.45	0.6-6.0	0.08-0.12	5.6-7.3	<2	Low--------	0.15	5	8	1-4
	6-22	18-30	1.35-1.60	0.6-2.0	0.14-0.18	5.6-7.3	<2	Low--------	0.24			
	22-60	15-25	1.60-1.70	0.6-6.0	0.13-0.17	5.6-7.3	<2	Low--------	0.24			
Satanta---------	0-9	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low--------	0.28	5	6	1-4
	9-26	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	26-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low--------	0.28			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
SeB-------------- Satanta	0-9	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low-------	0.28	5	6	1-4
	9-26	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	26-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low-------	0.28			
SfB*:												
Satanta---------	0-9	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low-------	0.28	5	6	1-4
	9-26	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	26-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low-------	0.28			
Arvada----------	0-3	10-20	1.25-1.35	2.0-6.0	0.13-0.15	6.6-9.0	<4	Low-------	0.24	3	3	.5-1
	3-12	35-60	1.20-1.40	<0.06	0.07-0.09	>7.8	<2	High------	0.32			
	12-60	28-45	1.20-1.40	0.06-0.2	0.09-0.11	>7.8	<4	High------	0.32			
ShD*:												
Satanta---------	0-9	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low-------	0.28	5	6	1-4
	9-26	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	26-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low-------	0.28			
Canyon----------	0-4	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.32	2	4L	.5-1
	4-18	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-------	0.43			
	18-60	---	---	---	---	---	---	---------	----			
SpE*:												
Sawdust---------	0-4	20-26	1.35-1.50	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low-------	0.17	5	8	2-4
	4-15	20-26	1.50-1.80	0.6-2.0	0.12-0.14	7.4-8.4	<2	Low-------	0.24			
	15-60	18-26	1.50-1.80	0.6-2.0	0.10-0.12	7.4-8.4	<2	Low-------	0.24			
Hopdraw---------	0-3	3-10	1.30-1.50	6.0-20	0.08-0.10	6.6-8.4	<2	Low-------	0.10	5	8	.5-1
	3-44	3-10	1.50-1.75	6.0-20	0.06-0.08	7.4-9.0	<2	Low-------	0.10			
	44-60	---	---	---	---	---	---	---------	----			
Paunsaugunt-----	0-6	18-25	1.25-1.30	0.6-6.0	0.13-0.16	7.4-8.4	<2	Moderate	0.20	2	8	2-4
	6-11	10-18	1.35-1.40	2.0-6.0	0.06-0.08	7.4-8.4	<2	Low-------	0.17			
	11-60	---	---	---	---	---	---	---------	----			
SrE*:												
Sawdust---------	0-4	20-26	1.35-1.50	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low-------	0.17	5	8	2-4
	4-8	20-26	1.50-1.80	0.6-2.0	0.12-0.14	7.4-8.4	<2	Low-------	0.24			
	8-60	18-26	1.50-1.80	0.6-2.0	0.10-0.12	7.4-8.4	<2	Low-------	0.24			
Vanocker--------	0-2	20-27	1.25-1.40	0.6-2.0	0.10-0.12	5.6-7.3	<2	Moderate	0.17	5	8	5-10
	2-13	25-34	1.40-1.60	0.6-2.0	0.09-0.11	5.6-7.8	<2	Moderate	0.24			
	13-60	18-27	1.45-1.70	0.6-2.0	0.09-0.11	7.4-8.4	<2	Moderate	0.24			
Paunsaugunt-----	0-6	18-25	1.25-1.30	0.6-6.0	0.13-0.16	7.4-8.4	<2	Moderate	0.20	2	8	2-4
	6-11	10-18	1.35-1.40	2.0-6.0	0.06-0.08	7.4-8.4	<2	Low-------	0.17			
	11-60	---	---	---	---	---	---	---------	----			
SwE-------------- Shirttail	0-6	15-25	1.25-1.45	0.6-2.0	0.12-0.15	5.6-7.3	<2	Low-------	0.20	5	8	2-5
	6-18	27-35	1.30-1.50	0.6-2.0	0.09-0.13	5.6-7.3	<2	Moderate	0.20			
	18-24	18-26	1.30-1.55	0.6-2.0	0.09-0.13	5.6-7.3	<2	Low-------	0.20			
	24-44	10-20	1.35-1.60	0.6-2.0	0.05-0.10	5.1-7.3	<2	Low-------	0.15			
	44-60	---	---	---	---	---	---	---------	----			
SxaE*:												
Spearfish-------	0-5	10-25	1.15-1.30	0.6-2.0	0.16-0.22	6.6-8.4	<2	Low-------	0.32	2	4L	1-3
	5-12	15-32	1.15-1.35	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low-------	0.32			
	12-60	---	---	---	---	---	---	---------	----			
Nevee-----------	0-8	10-18	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low-------	0.32	5	4L	1-3
	8-60	10-18	1.35-1.45	0.6-2.0	0.12-0.20	7.4-9.0	2-4	Low-------	0.43			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
SxbF*:												
Spearfish-------	0-5	10-25	1.15-1.30	0.6-2.0	0.16-0.22	6.6-8.4	<2	Low--------	0.32	2	4L	1-3
	5-12	15-32	1.15-1.35	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low--------	0.32			
	12-60	---	---	---	---	---	---	----------	----			
Rock outcrop.												
SyaC------------- Stovho	0-6	20-26	1.10-1.25	0.6-2.0	0.17-0.20	5.6-6.5	<2	Low--------	0.37	5	6	3-6
	6-17	35-60	1.35-1.50	0.06-0.6	0.14-0.17	5.6-7.3	<2	High-------	0.37			
	17-30	30-45	1.30-1.45	0.2-2.0	0.14-0.17	6.6-8.4	<2	Moderate	0.37			
	30-60	27-40	1.30-1.45	0.2-2.0	0.12-0.15	7.4-8.4	<2	Moderate	0.37			
SybC*:												
Stovho----------	0-6	20-26	1.10-1.25	0.6-2.0	0.17-0.20	5.6-6.5	<2	Low--------	0.37	5	6	3-6
	6-17	35-60	1.35-1.50	0.06-0.6	0.14-0.17	5.6-7.3	<2	High-------	0.37			
	17-30	30-45	1.30-1.45	0.2-2.0	0.14-0.17	6.6-8.4	<2	Moderate	0.37			
	30-60	27-40	1.30-1.45	0.2-2.0	0.12-0.15	7.4-8.4	<2	Moderate	0.37			
Lail------------	0-6	10-20	1.10-1.20	0.6-2.0	0.17-0.21	6.1-7.8	<2	Low--------	0.32	5	6	.5-1
	6-34	35-50	1.25-1.40	0.06-0.2	0.14-0.16	6.1-7.8	<2	High-------	0.28			
	34-60	30-40	1.20-1.40	0.2-0.6	0.19-0.21	7.9-9.0	<2	Moderate	0.37			
Trebor----------	0-3	5-15	1.30-1.40	0.6-2.0	0.12-0.15	5.6-6.5	<2	Low--------	0.28	4	8	2-5
	3-15	27-35	1.45-1.55	0.2-0.6	0.09-0.13	6.6-7.8	<2	Moderate	0.28			
	15-30	15-30	1.50-1.70	0.6-2.0	0.08-0.10	7.4-8.4	<2	Moderate	0.28			
	30-60	---	---	---	---	---	---	----------	----			
SycE*:												
Stovho----------	0-6	20-26	1.10-1.25	0.6-2.0	0.17-0.20	5.6-6.5	<2	Low--------	0.37	5	6	3-6
	6-17	35-60	1.35-1.50	0.06-0.6	0.14-0.17	5.6-7.3	<2	High-------	0.37			
	17-30	30-45	1.30-1.45	0.2-2.0	0.14-0.17	6.6-8.4	<2	Moderate	0.37			
	30-60	27-40	1.30-1.45	0.2-2.0	0.12-0.15	7.4-8.4	<2	Moderate	0.37			
Trebor----------	0-3	5-15	1.30-1.40	0.6-2.0	0.12-0.15	5.6-6.5	<2	Low--------	0.28	4	8	2-5
	3-15	27-35	1.45-1.55	0.2-0.6	0.09-0.13	6.6-7.8	<2	Moderate	0.28			
	15-30	15-30	1.50-1.70	0.6-2.0	0.08-0.10	7.4-8.4	<2	Moderate	0.28			
	30-60	---	---	---	---	---	---	----------	----			
TfA, TfB, TfC---- Tilford	0-5	15-27	1.15-1.30	0.6-2.0	0.19-0.22	6.6-7.8	<2	Low--------	0.32	5	6	2-4
	5-20	18-30	1.25-1.40	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low--------	0.43			
	20-60	18-30	1.25-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low--------	0.43			
TpC*:												
Tilford---------	0-5	15-27	1.15-1.30	0.6-2.0	0.19-0.22	6.6-7.8	<2	Low--------	0.32	5	6	2-4
	5-20	18-30	1.25-1.40	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low--------	0.43			
	20-60	18-30	1.25-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low--------	0.43			
Paunsaugunt-----	0-6	18-25	1.25-1.30	0.6-6.0	0.13-0.16	7.4-8.4	<2	Moderate	0.20	2	8	2-4
	6-11	10-18	1.35-1.40	2.0-6.0	0.06-0.08	7.4-8.4	<2	Low--------	0.17			
	11-60	---	---	---	---	---	---	----------	----			
TrB*:												
Tilford---------	0-5	15-27	1.15-1.30	0.6-2.0	0.19-0.22	6.6-7.8	<2	Low--------	0.32	5	6	2-4
	5-20	18-30	1.25-1.40	0.6-2.0	0.19-0.20	6.6-8.4	<2	Low--------	0.43			
	20-60	18-30	1.25-1.40	0.6-2.0	0.19-0.18	7.4-8.4	<2	Low--------	0.43			
Urban land.												

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
TuG*:												
Trebor----------	0-3	5-15	1.30-1.40	0.6-2.0	0.12-0.15	5.6-6.5	<2	Low--------	0.28	4	8	2-5
	3-15	27-35	1.45-1.55	0.2-0.6	0.09-0.13	6.6-7.8	<2	Moderate	0.28			
	15-30	15-30	1.50-1.70	0.6-2.0	0.08-0.10	7.4-8.4	<2	Moderate	0.28			
	30-60	---	---	---	---	---	---	----------	----			
Rock outcrop.												
VcF*:												
Vanocker--------	0-2	20-27	1.25-1.40	0.6-2.0	0.10-0.12	5.6-7.3	<2	Moderate	0.17	5	8	5-10
	2-13	25-34	1.40-1.60	0.6-2.0	0.09-0.11	5.6-7.8	<2	Moderate	0.24			
	13-60	25-34	1.45-1.70	0.6-2.0	0.09-0.11	7.4-8.4	<2	Moderate	0.24			
Citadel---------	0-10	10-20	1.20-1.35	0.6-2.0	0.16-0.18	5.1-7.3	<2	Low--------	0.37	5	5	2-4
	10-34	35-45	1.40-1.65	0.06-0.6	0.11-0.17	5.1-7.3	<2	High------	0.37			
	34-42	20-35	1.45-1.75	0.2-2.0	0.11-0.19	7.4-8.4	<2	Moderate	0.37			
	42-60	15-30	1.45-1.75	0.2-2.0	0.10-0.18	6.6-8.4	<2	Moderate	0.28			
VkE*:												
Vanocker--------	0-2	20-27	1.25-1.40	0.6-2.0	0.10-0.12	5.6-7.3	<2	Moderate	0.17	5	8	5-10
	2-13	25-34	1.40-1.60	0.6-2.0	0.09-0.11	5.6-7.8	<2	Moderate	0.24			
	13-60	25-34	1.45-1.70	0.6-2.0	0.09-0.11	7.4-8.4	<2	Moderate	0.24			
Lakoa-----------	0-5	10-20	1.15-1.25	0.6-2.0	0.15-0.20	5.1-7.3	<2	Low--------	0.32	5	5	1-3
	5-11	15-35	1.20-1.30	0.6-2.0	0.15-0.20	5.1-6.5	<2	Moderate	0.32			
	11-22	25-35	1.25-1.40	0.6-2.0	0.16-0.20	5.6-7.3	<2	Moderate	0.32			
	22-33	20-30	1.25-1.40	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.32			
	33-60	20-30	1.30-1.55	0.6-2.0	0.13-0.17	5.6-8.4	<2	Moderate	0.24			
VnC*:												
Vanocker--------	0-2	20-27	1.25-1.40	0.6-2.0	0.10-0.12	5.6-7.3	<2	Moderate	0.17	5	8	5-10
	2-13	25-34	1.40-1.60	0.6-2.0	0.09-0.11	5.6-7.8	<2	Moderate	0.24			
	13-60	25-34	1.45-1.70	0.6-2.0	0.09-0.11	7.4-8.4	<2	Moderate	0.24			
Paunsaugunt-----	0-6	18-25	1.25-1.30	0.6-6.0	0.13-0.16	7.4-8.4	<2	Moderate	0.20	2	8	2-4
	6-11	10-18	1.35-1.40	2.0-6.0	0.06-0.08	7.4-8.4	<2	Low--------	0.17			
	11-60	---	---	---	---	---	---	----------	----			
VoG*:												
Vanocker--------	0-2	20-27	1.25-1.40	0.6-2.0	0.10-0.12	5.6-7.3	<2	Moderate	0.17	5	8	5-10
	2-13	25-34	1.40-1.60	0.6-2.0	0.09-0.11	5.6-7.8	<2	Moderate	0.24			
	13-60	25-34	1.45-1.70	0.6-2.0	0.09-0.11	7.4-8.4	<2	Moderate	0.24			
Sawdust---------	0-4	20-26	1.35-1.50	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low--------	0.17	3	8	2-4
	4-8	20-26	1.50-1.80	0.6-2.0	0.12-0.14	7.4-8.4	<2	Low--------	0.24			
	8-60	18-26	1.50-1.80	0.6-2.0	0.10-0.12	7.4-8.4	<2	Low--------	0.24			
Rock outcrop.												
VpC*:												
Virkula---------	0-13	15-26	1.20-1.30	0.6-2.0	0.16-0.18	5.1-6.5	<2	Low--------	0.37	5	6	2-4
	13-45	20-34	1.20-1.40	0.2-0.6	0.12-0.17	5.1-6.5	<2	Moderate	0.37			
	45-60	18-30	1.30-1.50	0.2-2.0	0.10-0.15	5.6-7.3	<2	Moderate	0.37			
Pactola---------	0-11	10-25	1.30-1.50	0.6-2.0	0.12-0.15	5.6-6.5	<2	Low--------	0.24	3	8	2-5
	11-18	20-30	1.50-1.75	0.6-2.0	0.09-0.13	5.6-6.5	<2	Moderate	0.24			
	18-42	27-35	1.55-1.80	0.6-2.0	0.05-0.08	5.6-6.5	<2	Moderate	0.24			
	42-60	---	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors		Wind erodi- bility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
WtB-------------- Winetti	0-5	10-20	1.45-1.50	2.0-6.0	0.08-0.10	7.4-8.4	<2	Low--------	0.05	3	8	2-4
	5-30	5-15	1.40-1.45	2.0-6.0	0.06-0.11	7.4-8.4	<2	Low--------	0.15			
	30-60	5-10	1.35-1.40	2.0-6.0	0.04-0.08	7.4-8.4	<2	Low--------	0.10			
ZcC*:												
Zigweid---------	0-4	27-35	1.15-1.25	0.6-2.0	0.18-0.21	7.4-8.4	<2	Moderate	0.32	5	6	1-2
	4-60	18-35	1.25-1.40	0.6-2.0	0.16-0.21	7.9-9.0	<2	Moderate	0.43			
ZcC*:												
Canyon----------	0-4	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.32	2	4L	.5-1
	4-18	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.43			
	18-60	---	---	---	---	---	---	----------	----			
ZnD*:												
Zigweid---------	0-4	27-35	1.15-1.25	0.6-2.0	0.18-0.21	7.4-8.4	<2	Moderate	0.32	5	6	1-2
	4-60	18-35	1.25-1.40	0.6-2.0	0.16-0.21	7.9-9.0	<2	Moderate	0.43			
Nihill----------	0-7	10-27	1.15-1.25	0.6-2.0	0.12-0.16	7.4-8.4	<2	Low--------	0.10	5	5	.5-1
	7-60	18-30	1.30-1.40	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low--------	0.05			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "very brief," and "apparent" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
ApA----------------- Arvada Variant	D	Rare---------	---	---	1.0-3.0	Apparent	Jan-Dec	>60	---	High-----	High-----	High.
AsA*: Arvada------------	D	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Slickspots.												
BdA----------------- Barnum	B	Rare---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
BeB*: Barnum------------	B	Rare---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Winetti-----------	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
BrA, BrB----------- Bullflat	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
EsB*: Bullflat----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Cordeston---------	B	Rare---------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
BtE*: Buska-------------	B	None---------	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
Mocmont-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Rock outcrop.												
BuE*: Buska-------------	B	None---------	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
BuE*: Rock outcrop.												
BvC*: Buska-------------	B	None---------	---	---	>6.0	---	---	40-60	Soft	Moderate	High-----	Low.
Virkula-----------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
BwE*:												
Butche	D	None	---	---	>6.0	---	---	7-20	Hard	Low	Moderate	Low.
Rock outcrop.												
CcE*:												
Canyon	D	None	---	---	>6.0	---	---	8-20	Soft	Low	High	Low.
Bridget	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
CdF*:												
Canyon	D	None	---	---	>6.0	---	---	8-20	Soft	Low	High	Low.
Rock outcrop.												
CkC*:												
Citadel	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Vanocker	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
CoA Colombo	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
CpA*:												
Colombo	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Urban land.												
CvB Cordeston	B	Rare	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
CwB*:												
Cordeston	B	Rare	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Marshbrook	D	Occasional	Very brief	Apr-Oct	1.0-2.0	Apparent	Jan-Dec	>60	---	High	High	Low.
CxC*:												
Cordeston	B	Rare	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Winetti	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
DgB*:												
Demar	D	None	---	---	>6.0	---	---	>60	---	Low	High	High.
Grummit	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	High.
Slickspots.												

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
GbA---------------- Glenberg	B	Occasional	Very brief	Apr-Aug	>6.0	---	---	>60	---	Low------	Moderate	Low.
GrD*, GrF*:												
Grummit----------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	High.
Rock outcrop.												
GuC*:												
Gurney-----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Low.
Butche-----------	D	None--------	---	---	>6.0	---	---	7-20	Hard	Low------	Moderate	Low.
GvD*:												
Gypnevee---------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Low------	High-----	High.
Rekop------------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	High.
Rock outcrop.												
GyD*:												
Gypnevee---------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Low------	High-----	High.
Rock outcrop.												
Urban land.												
HaA---------------- Haverson	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
HeE---------------- Heely	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	High-----	Low.
HfC*:												
Heely------------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	High-----	Low.
Cordeston--------	B	Rare--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
HgB, HgD---------- Hilger	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
HmE*:												
Hilger-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Metre------------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
HnB*:												
Hilger-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Urban land.												
HoD*:												
Hilger-----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Virkula----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
HtG*:												
Hopdraw----------	A	None--------	---	---	>6.0	---	---	40-60	Hard	Low------	Low------	Low.
Sawdust----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Rock outcrop.												
JhD*:												
Judy-------------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Low.
Heath------------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
Paunsaugunt Variant---------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	Low------	Low.
MhA--------------- Marshbrook	D	Occasional--	Very brief	Apr-Oct	1.0-2.0	Apparent	Jan-Dec	>60	---	High-----	High-----	Low.
MnC*:												
Metre------------	D	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
Norrest----------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	High-----	Low.
MsC--------------- Mocmont	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
MtE*:												
Mocmont----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Rock outcrop.												
NaC--------------- Nevee	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
NbC--------------- Nevee	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
NcE*:												
Nevee------------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Moderate.
Gullied land.												
NfE*:												
Nihill-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Low.
Zigweid----------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
NnE*:												
Norrest----------	C	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Low.
Fairburn---------	D	None---------	---	---	>6.0	---	---	10-20	Soft	Low-------	Moderate	Low.
Metre------------	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Low.
PaE*:												
Pactola----------	B	None---------	---	---	>6.0	---	---	40-60	Hard	Moderate	High------	Low.
Virkula----------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Moderate.
Rock outcrop.												
PbD*:												
Paunsaugunt------	D	None---------	---	---	>6.0	---	---	10-20	Hard	Moderate	High------	Low.
Gurney-----------	B	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	High------	Low.
PcD*:												
Paunsaugunt------	D	None---------	---	---	>6.0	---	---	10-20	Hard	Moderate	High------	Low.
Rock outcrop.												
PgC*:												
Pierre-----------	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Moderate.
Grummit----------	D	None---------	---	---	>6.0	---	---	10-20	Soft	Low-------	High------	High.
Pt*. Pits												
ReC*:												
Redbird----------	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Low.
Heath------------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
RfE*:												
Rekop	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	High.
Gypnevee	B	None	---	---	>6.0	---	---	40-60	Soft	Low	High	High.
Rock outcrop.												
RgG*:												
Rock outcrop.												
Buska	B	None	---	---	>6.0	---	---	40-60	Soft	Moderate	High	Low.
RhD*:												
Rock outcrop.												
Butche	D	None	---	---	>6.0	---	---	7-20	Hard	Low	Moderate	Low.
RkG*:												
Rock outcrop.												
Mocmont	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
RlG*:												
Rock outcrop.												
Pactola	B	None	---	---	>6.0	---	---	40-60	Hard	Moderate	High	Low.
RmG*:												
Rock outcrop.												
Rekop	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	High.
RnG*:												
Rock outcrop.												
Sawdust	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
RpC*:												
Rockoa	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Lakoa	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
RrE*:												
Rockoa	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Lakoa	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Rock outcrop.												

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
RsF*:												
Rockoa	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Rock outcrop.												
RtD*:												
Rockoa	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
SeB Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
SfB*:												
Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Arvada	D	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
ShD*:												
Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Canyon	D	None	---	---	>6.0	---	---	8-20	Soft	Low	High	Low.
SpE*:												
Sawdust	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Hopdraw	A	None	---	---	>6.0	---	---	40-60	Hard	Low	Low	Low.
Paunsaugunt	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	Low.
SrE*:												
Sawdust	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Vanocker	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Paunsaugunt	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	Low.
SwE Shirttail	B	None	---	---	>6.0	---	---	40-60	Hard	Low	High	Low.
SxaE*:												
Spearfish	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	High.
Nevee	B	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
SxbF*:												
Spearfish--------	D	None---------	---	---	>6.0	---	---	6-20	Soft	Low------	High-----	High.
Rock outcrop.												
SyaC--------------- Stovho	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
SybC*:												
Stovho-----------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Lail-------------	C	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Trebor-----------	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Low.
SycE*:												
Stovho-----------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Trebor-----------	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Low.
TfA, TfB, TfC----- Tilford	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
TpC*:												
Tilford----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Paunsaugunt------	D	None---------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	Low.
TrB*:												
Tilford----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Urban land.												
TuG*:												
Trebor-----------	C	None---------	---	---	>6.0	---	---	20-40	Hard	Moderate	High-----	Low.
Rock outcrop.												
VcE*:												
Vanocker---------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Citadel----------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
VkE*:												
Vanocker---------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Lakoa------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
VnC*:												
Vanocker----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Paunsaugunt------	D	None---------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	Low.
VoG*:												
Vanocker----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Sawdust-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Rock outcrop.												
VpC*:												
Virkula-----------	C	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Pactola-----------	B	None---------	---	---	>6.0	---	---	40-60	Hard	Moderate	High-----	Low.
WtB--------------- Winetti	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
ZcC*:												
Zigweid-----------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	High-----	Low.
Canyon------------	D	None---------	---	---	>6.0	---	---	8-20	Soft	Low-------	High-----	Low.
ZnD*:												
Zigweid-----------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	High-----	Low.
Nihill------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Arvada	Fine, montmorillonitic, mesic Ustollic Natrargids
Arvada Variant	Fine, mixed, mesic Aquic Natrargids
Barnum	Fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Bridget	Coarse-silty, mixed, mesic Torriorthentic Haplustolls
Bullflat	Fine-loamy, mixed Typic Argiborolls
Buska	Loamy-skeletal, micaceous Typic Eutroboralfs
Butche	Loamy, mixed, nonacid, mesic Lithic Ustic Torriorthents
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Citadel	Fine, montmorillonitic Typic Eutroboralfs
Colombo	Fine-loamy, mixed, mesic Torrifluventic Haplustolls
Cordeston	Fine-loamy, mixed Cumulic Haploborolls
Demar	Fine, montmorillonitic, mesic Ustollic Paleargids
Fairburn	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Glenberg	Coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Grummit	Clayey, montmorillonitic, acid, mesic, shallow Ustic Torriorthents
Gurney	Fine-loamy, mixed Typic Argiborolls
Gypnevee	Coarse-silty, gypsic, mesic Ustic Torriorthents
Haverson	Fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Heath	Fine, montmorillonitic Argic Cryoborolls
Heely	Loamy-skeletal, mixed Typic Haploborolls
Hilger	Loamy-skeletal, mixed Typic Argiborolls
Hopdraw	Sandy-skeletal, mixed, frigid Typic Ustorthents
Judy	Fine, montmorillonitic Argic Cryoborolls
Lail	Fine, montmorillonitic Typic Cryoboralfs
Lakoa	Fine-loamy, mixed Typic Eutroboralfs
Marshbrook	Fine-loamy, mixed, frigid Cumulic Haplaquolls
Metre	Very fine, montmorillonitic, mesic Mollic Torrerts
Mocmont	Loamy-skeletal, mixed Typic Eutroboralfs
Nevee	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Nihill	Loamy-skeletal, mixed (calcareous), mesic Ustic Torriorthents
Norrest	Fine, montmorillonitic, mesic Ustollic Haplargids
Pactola	Loamy-skeletal, mixed Typic Eutroboralfs
Paunsaugunt	Loamy-skeletal, mixed Lithic Haploborolls
Paunsaugunt Variant	Loamy-skeletal, mixed Lithic Cryoborolls
Pierre	Very fine, montmorillonitic, mesic Typic Torrerts
Redbird	Loamy-skeletal, mixed Argic Pachic Cryoborolls
Rekop	Loamy, gypsic, mesic, shallow Ustic Torriorthents
Rockoa	Loamy-skeletal, mixed Typic Eutroboralfs
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Sawdust	Loamy-skeletal, mixed (calcareous), frigid Typic Ustorthents
Shirttail	Loamy-skeletal, mixed Typic Argiborolls
Spearfish	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Stovho	Fine, montmorillonitic Typic Cryoboralfs
Tilford	Fine-silty, mixed, mesic Torriorthentic Haplustolls
Trebor	Loamy-skeletal, mixed Typic Cryoboralfs
Vanocker	Loamy-skeletal, mixed Typic Eutroboralfs
Virkula	Fine-silty, mixed Typic Eutroboralfs
Winetti	Loamy-skeletal, mixed (calcareous), frigid Typic Ustifluvents
Zigweid	Fine-loamy, mixed, mesic Ustollic Camborthids

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil is not assigned to the interpretive group)

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Grazable woodland group
ApA---Arvada Variant	VIIs-9	Saline Lowland	10	---
AsA:				
Arvada	VIs-3	Thin Claypan	10	---
Slickspots	VIIIs-3	---	---	---
BdA---Barnum	IIIc-2	Silty	1	---
BeB:				
Barnum	IVe-8	Overflow	1	---
Winetti	VIs-4	Overflow	10	---
BrA---Bullflat	IVc-1	Silty	3	---
BrB---Bullflat	IVe-1	Silty	3	---
BsB:				
Bullflat	IVe-1	Silty	3	---
Cordeston	IVe-1	Overflow	3	---
BtE:				
Buska	VIIe-9	---	---	Rocky Side Slopes.
Mocmont	VIIe-9	---	---	Rocky Side Slopes.
Rock outcrop	VIIIs-1	---	---	---
BuE:				
Buska	VIIe-9	---	---	Rocky Side Slopes.
Rock outcrop	VIIIs-1	---	---	---
BvC:				
Buska	VIe-13	---	---	Rocky Side Slopes.
Virkula	VIe-13	---	---	Silty Foot Slopes.
BwE:				
Butche	VIIs-1	---	---	Shallow Ridge.
Rock outcrop	VIIIs-1	---	---	---
CcE:				
Canyon	VIe-11	Shallow	10	---
Bridget	IVe-1	Silty	3	---
CdF:				
Canyon	VIIe-4	Shallow	10	---
Rock outcrop	VIIIs-1	---	---	---
CkC:				
Citadel	VIe-13	---	---	Silty Foot Slopes.
Vanocker	VIe-13	---	---	Cool Slopes.
CoA---Colombo	VIw-1	Overflow	3	---

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Grazable woodland group
CpA:				
Colombo.				
Urban land.				
CvB-------------------- Cordeston	IVe-1	Overflow-----------	3	---
CwB:				
Cordeston-------------	IIIe-1	Overflow-----------	3	---
Marshbrook------------	Vw-1	Subirrigated-------	2	---
CxC:				
Cordeston-------------	IVe-14	Overflow-----------	3	---
Winetti---------------	VIs-4	Overflow-----------	10	---
DgB:				
Demar-----------------	VIs-3	Claypan------------	9	---
Grummit---------------	VIe-12	Shallow Clay-------	10	---
Slickspots------------	VIIIs-3	---	---	---
GbA-------------------- Glenberg	IVe-6	Sandy--------------	1	---
GrD:				
Grummit---------------	VIe-12	Shallow Clay-------	10	---
Rock outcrop----------	VIIIs-2	---	---	---
GrF:				
Grummit---------------	VIIe-5	Shallow Clay-------	10	---
Rock outcrop----------	VIIIs-2	---	---	---
GuC:				
Gurney----------------	IVs-4	Silty--------------	6R	---
Butche----------------	VIs-1	Shallow------------	10	---
GvD:				
Gypnevee--------------	VIe-3	Thin Upland--------	10	---
Rekop-----------------	VIe-3	Shallow------------	10	---
Rock outcrop----------	VIIIs-1	---	---	---
GyD:				
Gypnevee.				
Rock outcrop.				
Urban land.				
HaA-------------------- Haverson	IIIc-2	Loamy Terrace------	1	---
HeE-------------------- Heely	VIIe-1	Mountain Prairie---	10	---
HfC:				
Heely-----------------	VIe-13	Mountain Prairie---	10	---
Cordeston-------------	IVe-1	Overflow-----------	3	---
HgB-------------------- Hilger	VIs-4	Stony Hills--------	10	---
HgD-------------------- Hilger	VIe-13	Stony Hills--------	10	---

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Grazable woodland group
HmE:				
Hilger	VIe-3	Stony Hills	10	---
Metre	VIe-4	Clayey	4C	---
HnB:				
Hilger.				
Urban land.				
HoD:				
Hilger	VIe-13	---	---	Rocky Side Slopes.
Virkula	VIe-13	---	---	Silty Foot Slopes.
HtG:				
Hopdraw	VIIe-9	---	---	---
Sawdust	VIIe-9	---	---	---
Rock outcrop	VIIIs-1	---	---	---
JhD:				
Judy	VIe-13	High Country Silty	10	---
Heath	VIe-13	High Country Silty	10	---
Paunsaugunt	VIIs-1	High Country Shallow	10	---
MhA Marshbrook	Vw-1	Subirrigated	2	---
MnC:				
Metre	IVe-3	Clayey	4C	---
Norrest	IVe-3	Clayey	4C	---
MsC Mocmont	VIe-13	---	---	Rocky Side Slopes.
MtE:				
Mocmont	VIIe-9	---	---	Rocky Side Slopes.
Rock outcrop	VIIIs-1	---	---	---
NaC Nevee	VIe-3	Thin Upland	10	---
NbC Nevee	IVe-8	Thin Upland	8	---
NcE:				
Nevee	VIe-3	Thin Upland	10	---
Gullied land	VIIIs-2	---	---	---
NfE:				
Nihill	VIIe-1	Thin Upland	10	---
Zigweid	VIe-1	Thin Upland	10	---
NnE:				
Norrest	VIe-5	Stony Hills	10	---
Fairburn	VIe-11	Stony Hills	10	---
Metre	VIe-4	Clayey	10	---
PaE:				
Pactola	VIIe-9	---	---	Rocky Side Slopes.
Virkula	VIe-13	---	---	Silty Foot Slopes.
Rock outcrop	VIIIs-1	---	---	---

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Grazable woodland group
PbD:				
Paunsaugunt	VIIs-1	Shallow	10	---
Gurney	IVs-4	Silty	6R	---
PcD:				
Paunsaugunt	VIIs-1	---	---	Shallow Ridge.
Rock outcrop	VIIIs-1	---	---	---
PgC:				
Pierre	IVe-1	Clayey	4C	---
Grummit	VIe-12	Shallow Clay	10	---
Pt	VIIIs-2	---	---	---
Pits				
ReC:				
Redbird	VIs-4	High Country Overflow	10	---
Heath	VIe-13	High Country Silty	10	---
RfE:				
Rekop	VIIe-4	Shallow	10	---
Gypnevee	VIe-3	Thin Upland	10	---
Rock outcrop	VIIIs-1	---	---	---
RgG:				
Rock outcrop	VIIIs-1	---	---	---
Buska	VIIe-9	---	---	---
RhD:				
Rock outcrop	VIIIs-1	---	---	---
Butche	VIs-1	---	---	Shallow Ridge.
RkG:				
Rock outcrop	VIIIs-1	---	---	---
Mocmont	VIIe-9	---	---	---
RlG:				
Rock outcrop	VIIIs-1	---	---	---
Pactola	VIIe-9	---	---	---
RmG:				
Rock outcrop	VIIIs-1	---	---	---
Rekop	VIIe-4	Shallow	10	---
RnG:				
Rock outcrop	VIIIs-1	---	---	---
Sawdust	VIIe-9	---	---	---
RpC:				
Rockoa	VIIe-1	---	---	Cool Slopes.
Lakoa	VIe-13	---	---	Silty Foot Slopes.
RrE:				
Rockoa	VIIe-1	---	---	Cool Slopes.
Lakoa	VIe-13	---	---	Silty Foot Slopes.
Rock outcrop	VIIIs-1	---	---	---
RsF:				
Rockoa	VIIe-1	---	---	Cool Slopes.
Rock outcrop	VIIIs-1	---	---	---

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Grazable woodland group
RtD:				
Rockoa	VIIe-1	---	---	Cool Slopes.
Satanta	IVe-1	Silty	3	---
SeB Satanta	IIIe-1	Silty	3	---
SfB:				
Satanta	IIIe-1	Silty	3	---
Arvada	VIs-3	Thin Claypan	10	---
ShD:				
Satanta	IVe-1	Silty	3	---
Canyon	VIe-11	Shallow	10	---
SpE:				
Sawdust	VIIe-9	---	---	Warm Slopes.
Hopdraw	VIIe-9	---	---	Warm Slopes.
Paunsaugunt	VIIs-1	---	---	Shallow Ridge.
SrE:				
Sawdust	VIIe-9	---	---	Warm Slopes.
Vanocker	VIIe-9	---	---	Cool Slopes.
Paunsaugunt	VIIs-1	---	---	Shallow Ridge.
SwE Shirttail	VIIe-9	Savannah	10	---
SxaE:				
Spearfish	VIe-11	Shallow	10	---
Nevee	VIe-3	Thin Upland	10	---
SxbF:				
Spearfish	VIIe-4	Shallow	10	---
Rock outcrop	VIIIs-1	---	---	---
SyaC Stovho	VIe-13	---	---	High Woodland.
SybC:				
Stovho	VIe-13	---	---	High Woodland.
Lail	VIe-13	---	---	High Woodland.
Trebor	VIe-13	---	---	High Woodland.
SycE:				
Stovho	VIIe-9	---	---	High Woodland.
Trebor	VIIe-9	---	---	High Woodland.
TfA Tilford	IIIc-1	Silty	3	---
TfB Tilford	IIIe-1	Silty	3	---
TfC Tilford	IVe-1	Silty	3	---
TpC:				
Tilford	IVe-1	Silty	3	---
Paunsaugunt	VIs-2	Shallow	10	---

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

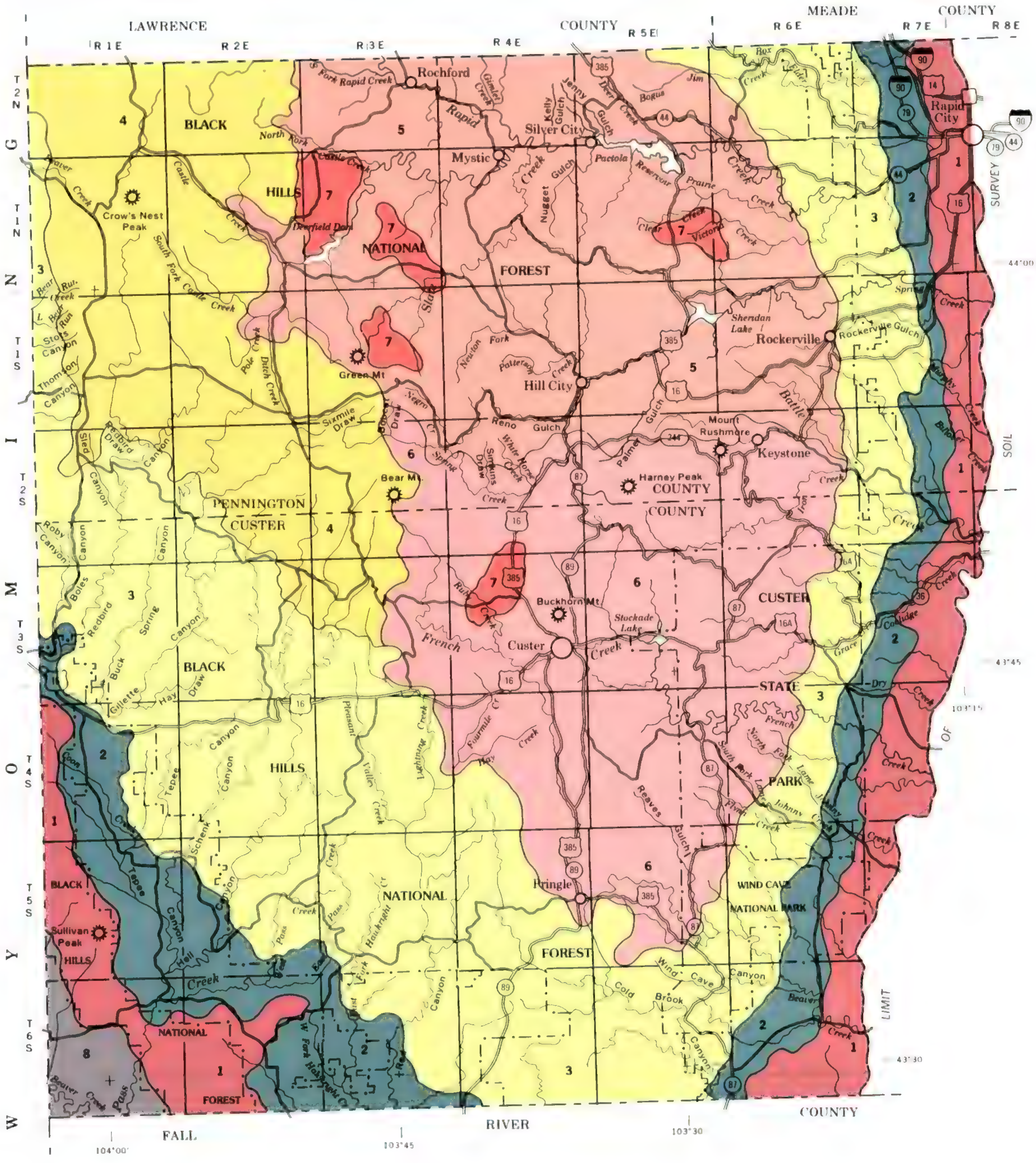
Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Grazable woodland group
TrB:				
Tilford.				
Urban land.				
TuG:				
Trebor	VIIe-9	---	---	---
Rock outcrop	VIIIs-1	---	---	---
VcE:				
Vanocker	VIIe-9	---	---	Cool Slopes.
Citadel	VIe-13	---	---	Silty Foot Slopes.
VkE:				
Vanocker	VIIe-9	---	---	Cool Slopes.
Lakoa	VIe-13	---	---	Silty Foot Slopes.
VnC:				
Vanocker	VIe-13	---	---	Cool Slopes.
Paunsaugunt	VIIs-1	---	---	Shallow Ridge.
VoG:				
Vanocker	VIIe-9	---	---	---
Sawdust	VIIe-9	---	---	---
Rock outcrop	VIIIs-1	---	---	---
VpC:				
Virkula	VIe-13	---	---	Silty Foot Slopes.
Pactola	VIe-13	---	---	Rocky Side Slopes.
WtB: Winetti	VIs-4	Overflow	10	---
ZcC:				
Zigweid	VIe-1	Thin Upland	8	---
Canyon	VIe-11	Shallow	10	---
ZnD:				
Zigweid	VIe-1	Thin Upland	8	---
Nihill	VIe-5	Thin Upland	8	---

* Soils in windbreak suitability group 10 are unsuited to windbreaks.

U.S. GOVERNMENT PRINTING OFFICE: 1991-281-364/40003

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.



N

SOIL LEGEND *

1 CANYON-ROCKOA-ROCK OUTCROP association: Rock outcrop and shallow and deep, well drained, gently sloping to very steep, loamy soils formed in material weathered from interbedded limestone, sandstone, and shale; on uplands and mountains

2 NEVEE-GYPNEVEE-REKOP association: Deep and shallow, well drained and somewhat excessively drained, gently sloping to very steep, silty and loamy soils formed in material weathered from siltstone, sandstone, silty shale, and gypsum; on uplands

3 VANOCKER-SAWDUST-PAUNSAUGUNT association: Deep and shallow, well drained, gently sloping to very steep, loamy soils formed in material weathered from limestone and calcareous sandstone; on mountains

4 STOVHO-TREBOR association: Deep and moderately deep, well drained, gently sloping to very steep, silty soils formed in material weathered from limestone and calcareous sandstone; on mountains

5 PACTOLA-ROCK OUTCROP-VIRKUL association: Rock outcrop and deep, well drained, gently sloping to very steep, loamy soils formed in material weathered from steeply tilted metamorphic rock; on mountains

6 BUSKA-MOCMONT-ROCK OUTCROP association: Rock outcrop and deep, well drained, gently sloping to very steep, loamy soils formed in material weathered from micaceous schist and granite; on mountains

7 HEELY-CORDESTON association: Moderately deep and deep, well drained, nearly level to steep, loamy soils formed in material weathered from steeply tilted metamorphic rock and in alluvium; on mountain prairies

8 GRUMMIT-ARVADA association: Shallow and deep, well drained, nearly level to very steep, clayey and loamy soils formed in material weathered from acid shale and sedimentary rock; on uplands

* Unless otherwise indicated, the texture terms in the descriptive headings refer to the surface layer of the major soils in each association

Compiled 1985

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION

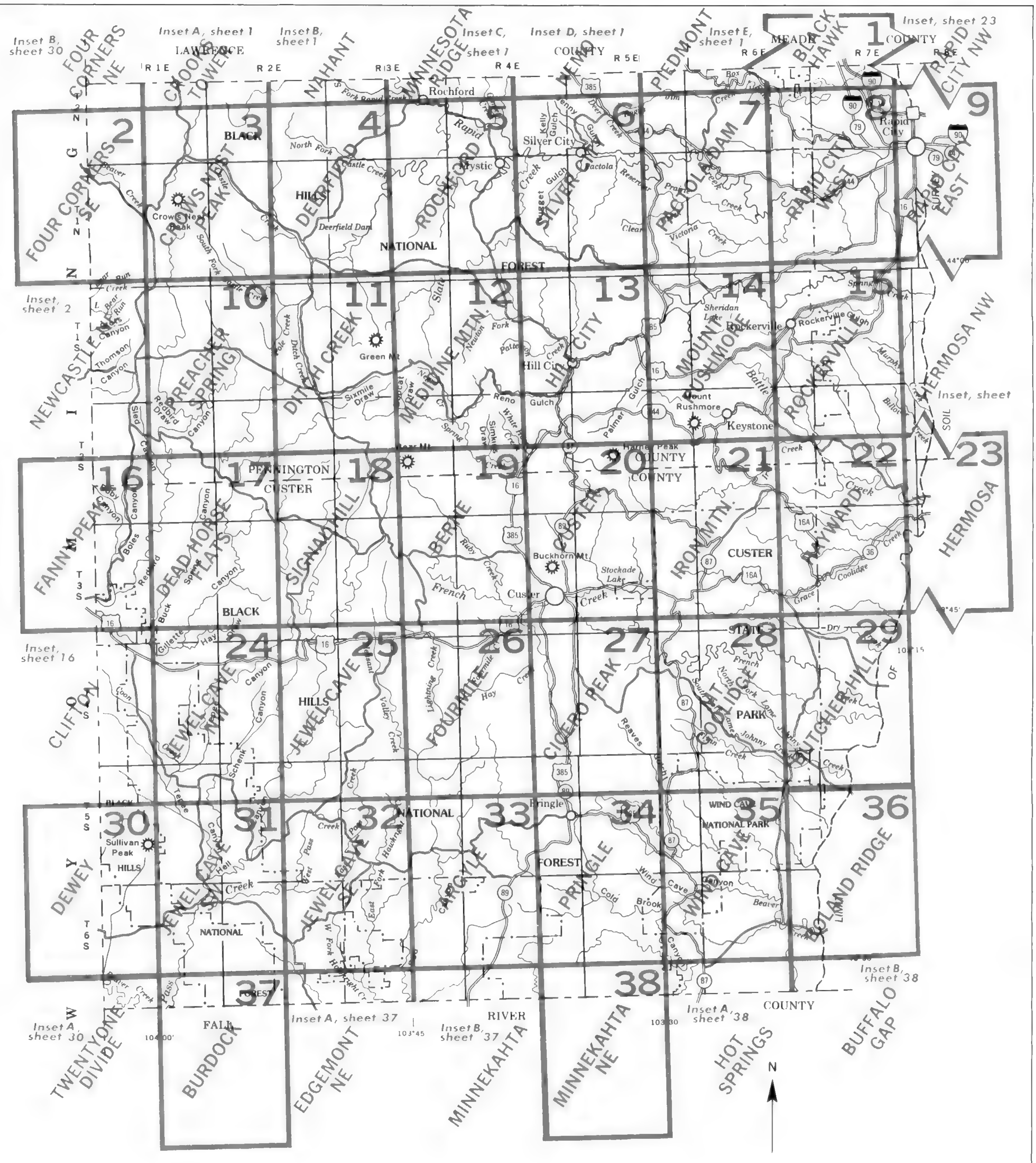
GENERAL SOIL MAP

CUSTER AND PENNINGTON COUNTIES, SOUTH DAKOTA BLACK HILLS PARTS

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

CUSTER AND PENNINGTON COUNTIES, SOUTH DAKOTA
BLACK HILLS PARTS

Scale 1:316,800

1 0 1 2 3 4 5 Miles

1 0 5 10 Km

SOIL LEGEND

Map symbols consist of a combination of letters. The first capital letter is the initial one of the map unit name. The lowercase letters that follow separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope.

SYMBOL	NAME
ApA	Arvada Variant loam, 0 to 2 percent slopes
AsA	Arvada-Slickspots complex, 0 to 3 percent slopes
BdA	Barnum very fine sandy loam, 0 to 3 percent slopes
BeB	Barnum-Winetti complex, 0 to 6 percent slopes
BrA	Bullflat silt loam, 0 to 3 percent slopes
BrB	Bullflat silt loam, 3 to 6 percent slopes
BsB	Bullflat-Cordeston silt loams, 2 to 9 percent slopes
BtE	Buska-Moocont-Rock outcrop complex, 10 to 40 percent slopes
BuE	Buska-Rock outcrop complex, 10 to 40 percent slopes
BvC	Buska-Virkula loams, 2 to 15 percent slopes
BwE	Butche-Rock outcrop complex, 9 to 60 percent slopes
CcE	Canyon-Bridget complex, 9 to 25 percent slopes
CdF	Canyon-Rock outcrop comlex, 15 to 60 percent slopes
CkC	Citadel-Vanocker complex, 2 to 12 percent slopes
CoA	Colombo loam, channeled, 0 to 4 percent slopes
CpA	Colombo-Urban land complex, 0 to 2 percent slopes
CvB	Cordeston loam, 2 to 10 percent slopes
CwB	Cordeston-Marshbrook loams, 0 to 6 percent slopes
CxC	Cordeston-Winetti complex, 2 to 9 percent slopes
DgB	Demar-Grummit-Slickspots complex, 0 to 6 percent slopes
GbA	Glenberg fine sandy loam, 0 to 4 percent slopes
GrD	Grummit-Rock outcrop complex, 6 to 15 percent slopes
GrF	Grummit-Rock outcrop complex, 15 to 60 percent slopes
GuC	Gurney-Butche complex, 2 to 9 percent slopes
GvD	Gypnevee-Rekop-Rock outcrop complex, 6 to 15 percent slopes
GyD	Gypnevee-Rock outcrop-Urban land complex, 9 to 25 percent slopes
HaA	Haverson loam, 0 to 2 percent slopes
HeE	Heely channery loam, 9 to 30 percent slopes
HfC	Heely, cordeston complex, 6 to 15 percent slopes
HgB	Hilger cobbly loam, 0 to 6 percent slopes
HgD	Hilger cobbly loam, 6 to 40 percent slopes
HmE	Hilger-Metre complex, 10 to 40 percent slopes
HnB	Hilger-Urban land complex, 0 to 6 percent slopes
HoD	Hilger-Virkula complex, 2 to 30 percent slopes
HtG	Hopdraw-Sawdust-Rock outcrop complex, 40 to 80 percent slopes
JhD	Judy-Heath-Paunsaugunt Variant complex, 2 to 25 percent slopes
MhA	Marshbrook loam, 0 to 3 percent slopes
MnC	Metre-Norrest complex, 2 to 9 percent slopes
MsC	Moocont gravelly loam, 2 to 12 percent slopes
MtE	Moocont-Rock outcrop complex, 10 to 40 percent slopes
NaC	Nevee channery loam, 6 to 15 percent slopes
NbC	Nevee silt loam, 2 to 9 percent slopes
NcE	Nevee-Gullied land complex, 6 to 40 percent slopes
NfE	Nihill-Zigweid complex, 15 to 50 percent slopes
NnE	Norrest-Fairburn-Metre complex, 9 to 40 percent slopes
PaE	Pactola-Virkula-Rock outcrop complex, 10 to 40 percent slopes
PbD	Paunsaugunt-Gurney complex, 2 to 15 percent slopes
PcD	Paunsaugunt-Rock outcrop complex, 6 to 30 percent slopes
PgC	Peirre-Grummit clays, 2 to 9 percent slopes
Pt	Pits, quarries
ReC	Redbird-Heath silt loams, 2 to 9 percent slopes
RfE	Rekop-Gypnevee-Rock outcrop complex, 15 to 40 percent slopes
RgG	Rock outcrop-Buska complex, 40 to 80 percent slopes
RhD	Rock outcrop-Butche complex, 2 to 25 percent slopes
RkG	Rock outcrop-Moocont complex, 40 to 80 percent slopes
Rtg	Rock outcrop-Pactola complex, 40 to 80 percent slopes
RmG	Rock outcrop-Rekop complex, 40 to 80 percent slopes
RnG	Rock outcrop-Sawdust complex, 40 to 80 percent slopes
RpC	Rockoa-Lakoa complex, 3 to 12 percent slopes
RrE	Rockoa-Lakoa-Rock outcrop complex, 10 to 40 percent slopes
RsF	Rockoa-Rock outcrop complex, 25 to 60 percent slopes
RtD	Rockoa-Satanta complex, 6 to 30 percent slopes
SeB	Satanta loam, 2 to 6 percent slopes
SfB	Satanta-Arvada complex, 2 to 6 percent slopes
ShD	Satanta-Canyon loams, 6 to 15 percent slopes
SpE	Sawdust-Hopdraw-Paunsaugunt complex, 10 to 40 percent slopes
SrE	Sawdust-Vanocker-Paunsaugunt complex, 10 to 40 percent slopes
SwE	Shirttail channery loam, 10 to 40 percent slopes
SxaE	Spearfish-Nevee silt loams, 9 to 30 percent slopes
SxbF	Spearfish-Rock outcrop complex, 25 to 60 percent slopes
SyaC	Stovho silt loam, 2 to 15 percent slopes
SybC	Stovho-Lail-Trebor complex, 2 to 12 percent slopes
SycE	Stovho-Trebor complex, 10 to 40 percent slopes
TfA	Tilford silt loam, 0 to 2 percent slopes
TfB	Tilford silt loam, 2 to 6 percent slopes
TfC	Tilford silt loam, 6 to 15 percent slopes
TpC	Tilford-Paunsaugunt complex, 6 to 9 percent slopes
TrB	Tilford-Urban land complex, 0 to 9 percent slopes
TuG	Trebor-Rock outcrop complex, 40 to 80 percent slopes
VcE	Vanocker-Citadel complex, 10 to 40 percent slopes
VkE	Vanocker-Lakoa complex, 10 to 40 percent slopes
VnC	Vanocker-Paunsaugunt complex, 2 to 15 percent slopes
VoG	Vanocker-Sawdust-Rock outcrop complex, 40 to 80 percent slopes
VpC	Virkula-Pactola complex, 2 to 15 percent slopes
WtB	Winetti cobbly loam, 2 to 10 percent slopes
ZcC	Zigweid-Canyon complex, 2 to 15 percent slopes
ZnD	Zigweid-Nihill complex, 6 to 15 percent slope

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
  - Along hogback
- Field sheet matchline and neatline

AD HOC BOUNDARY (label) — Swift Airport

- Small airport, airfield, park, oilfield, cemetery, or flood pool — FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate — 21
- Federal — 173
- State — 28
- County, farm or ranch — 1283

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small — water

PITS

- Gravel pit (< 5 acres)
- Mine or quarry (< 5 acres)

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas) (Rural Areas)
- Church (Rural Areas)
- School (Rural Areas)
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — Gas
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — PaE RpC

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

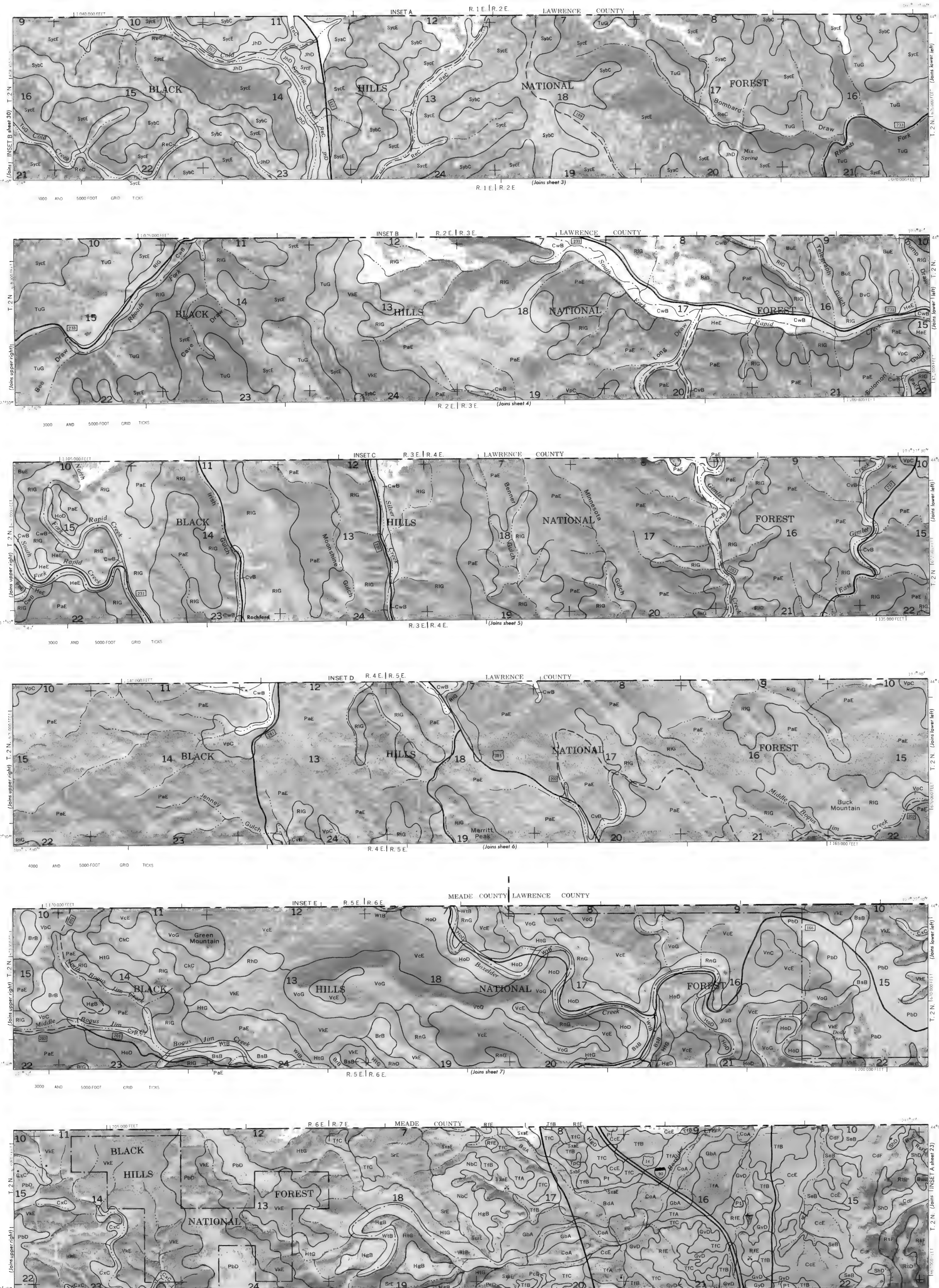
GULLY

DEPRESSION OR SINK

SOIL SAMPLE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot



Scale 1:24000

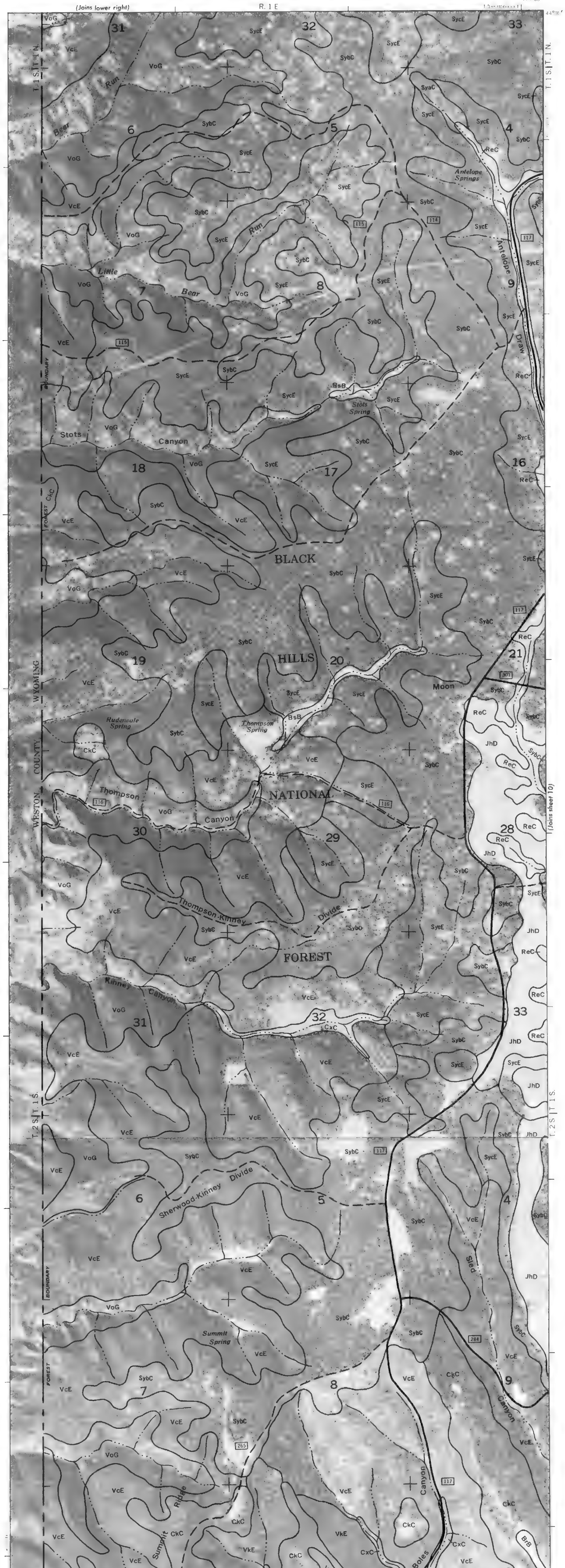
3/4 1/2 1/4 0 1 2 MILES

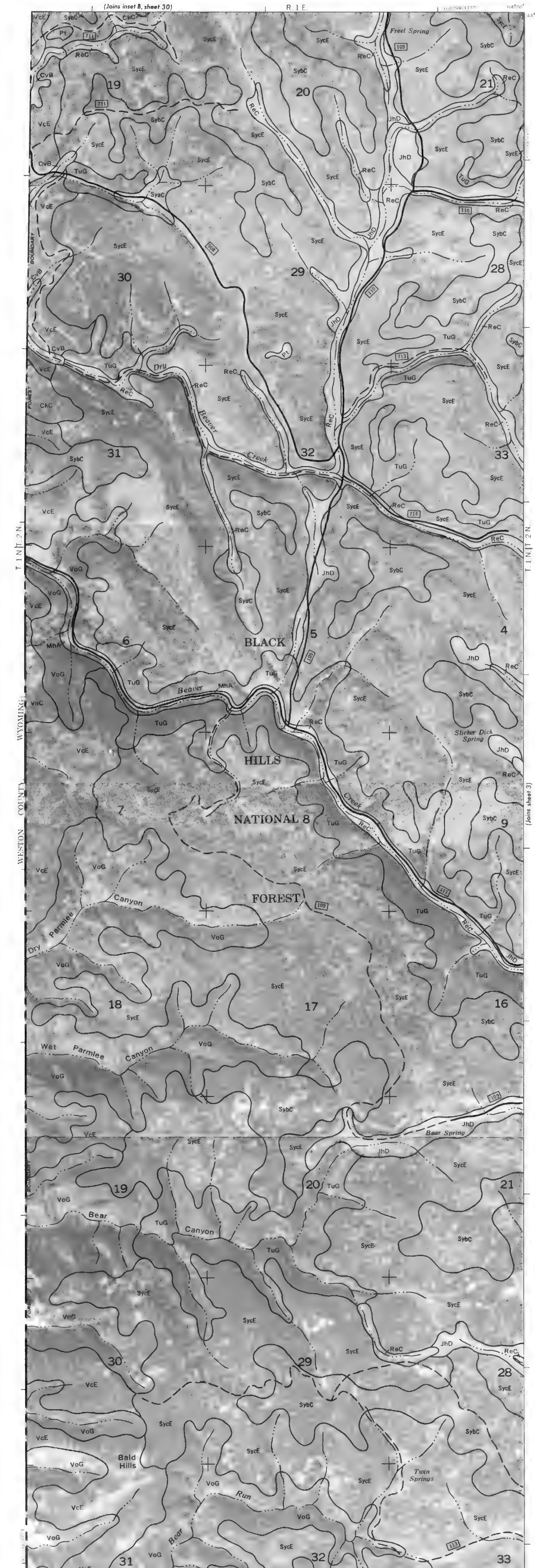
1 0.5 0 1 2 KILOMETERS

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 2
CUSTER AND PENNINGTON COUNTIES, SOUTH DAKOTA
BLACK HILLS PARTS





Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 3
CUSTER AND PENNINGTON COUNTIES, SOUTH DAKOTA
BLACK HILLS PARTS

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24 000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

1 3/4 1/2 1/4 0 1 2 MILES

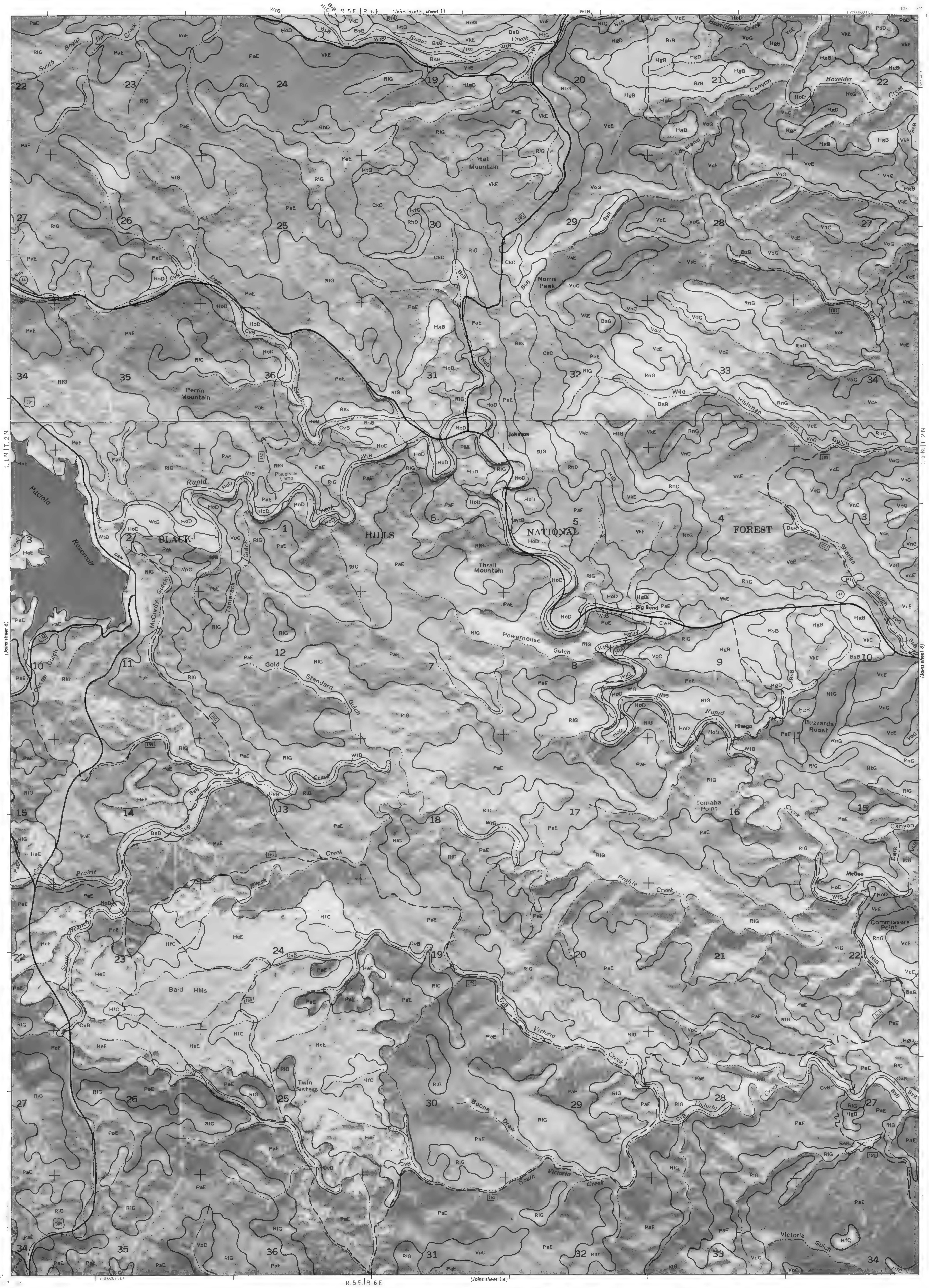
1 0.5 0 1 2 KILOMETERS

Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.



Scale 1:24 000

3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

3/4 1/2 1/4 0 1 2 MILES

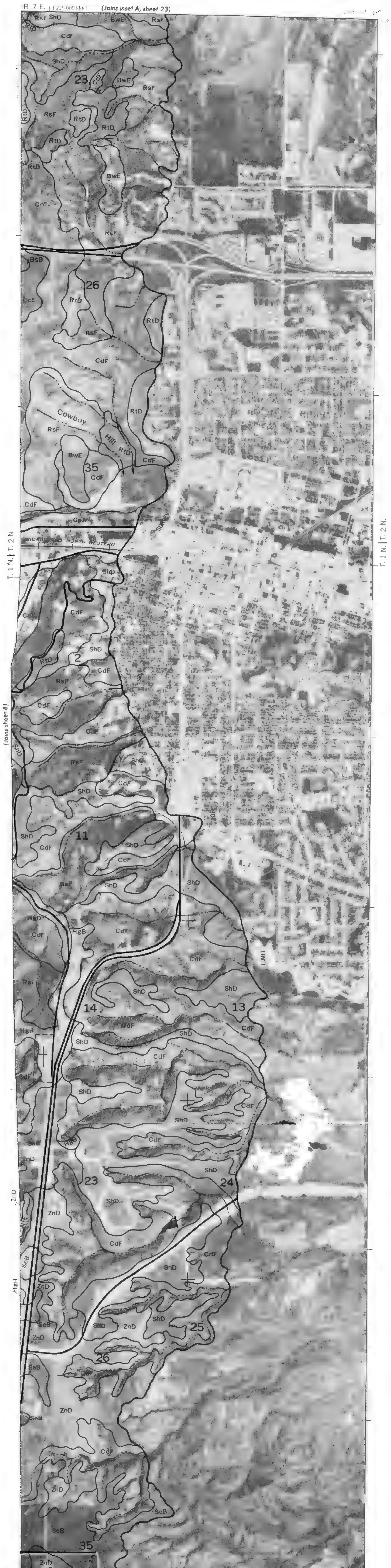
1 0.5 0 1 2 KILOMETERS

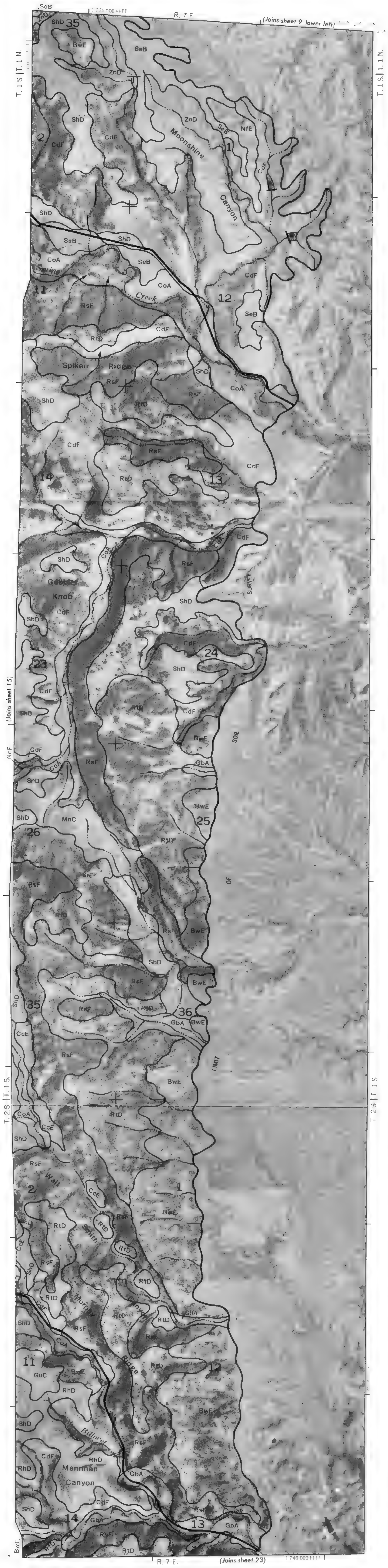
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 9
CUSTER AND PENNINGTON COUNTIES, SOUTH DAKOTA
BLACK HILLS PARTS





1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

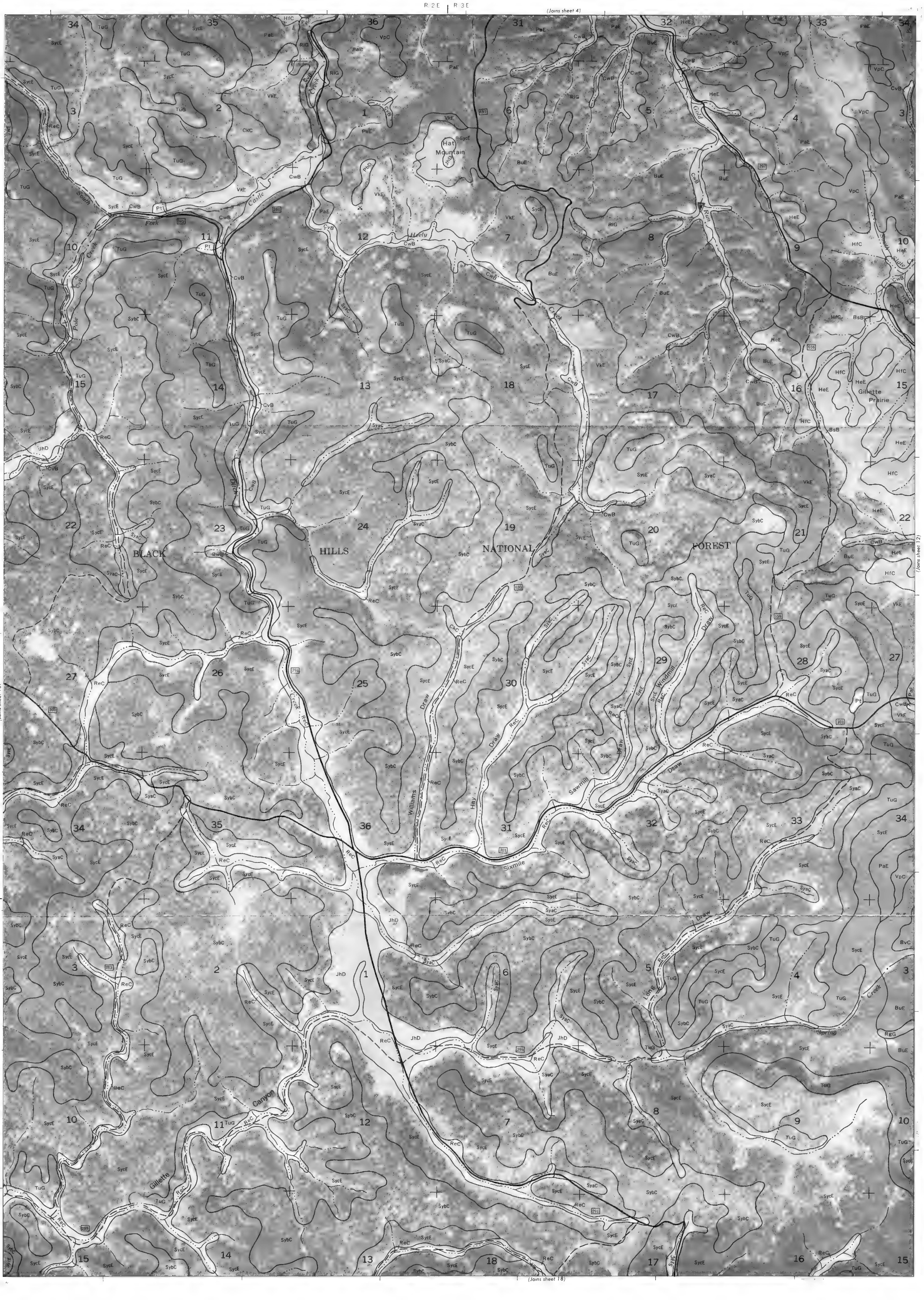
This soil survey was compiled by U.S. Department of Agriculture,
Soil Conservation Service and cooperating agencies on 1975-1982
USGS orthophotography.

Scale 1:24000

2 MILES

2 KILOMETERS

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.



This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

1 3/4 1/2 1/4 0 1 2 MILES

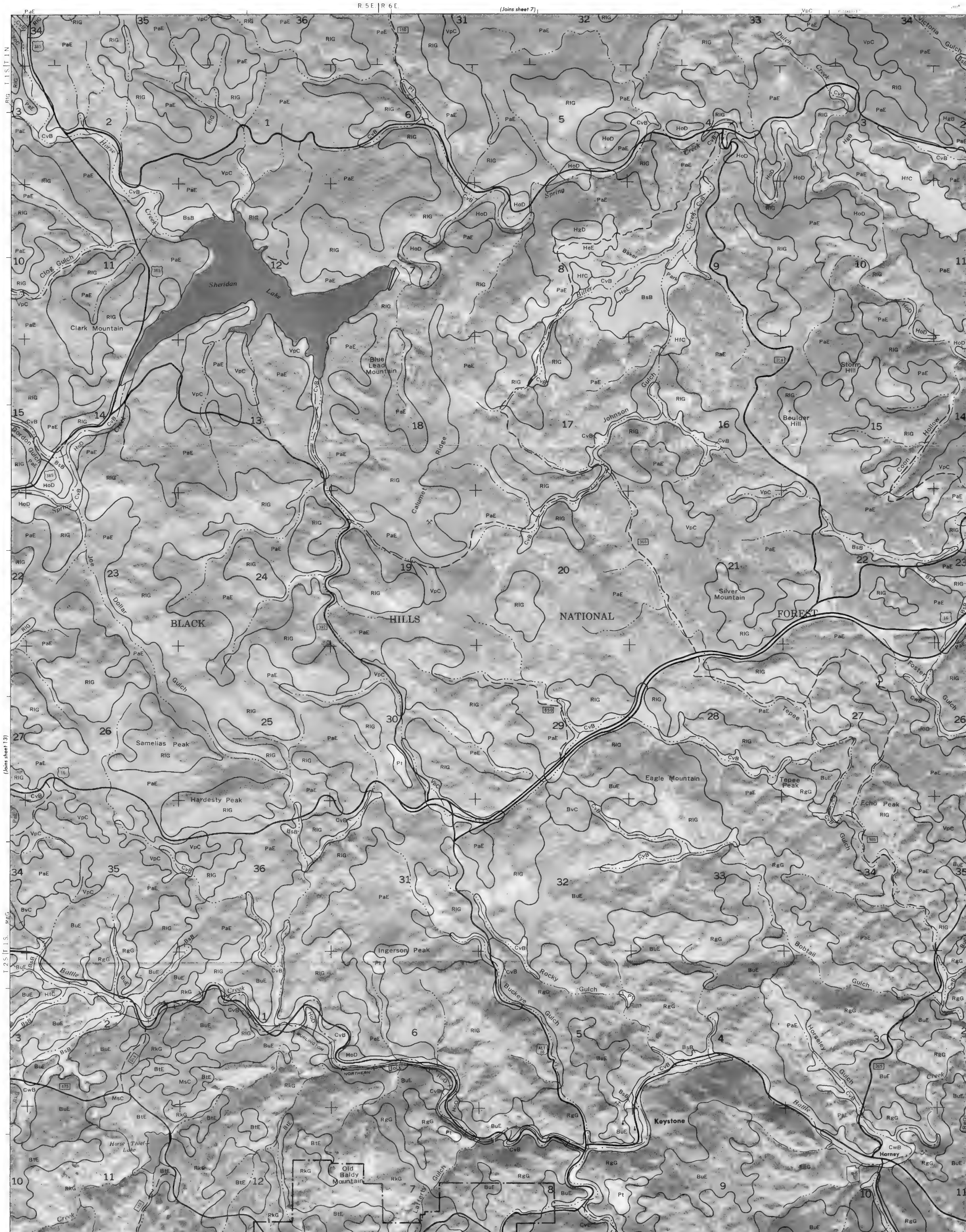
1 0.5 0 1 2 KILOMETERS

Scale 1:24 000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.



1 3/4 1/2 1/4 0 1 2 MILES

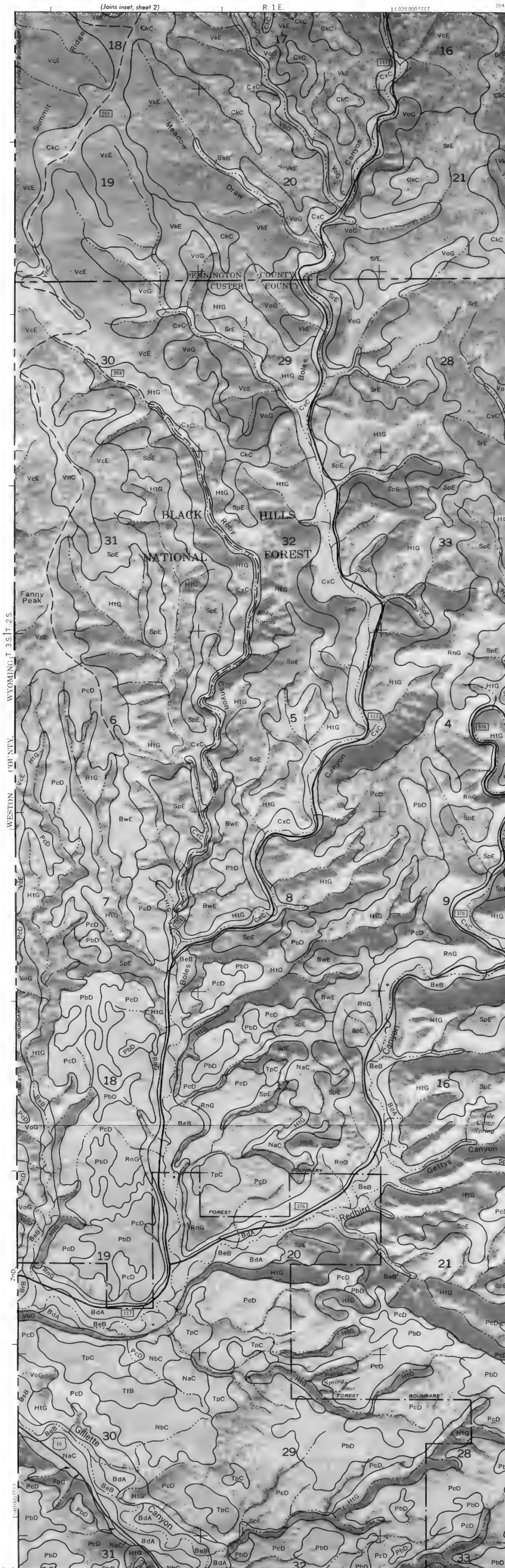
1 0.5 0 1 2 KILOMETERS

Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.



Scale 1:24000

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

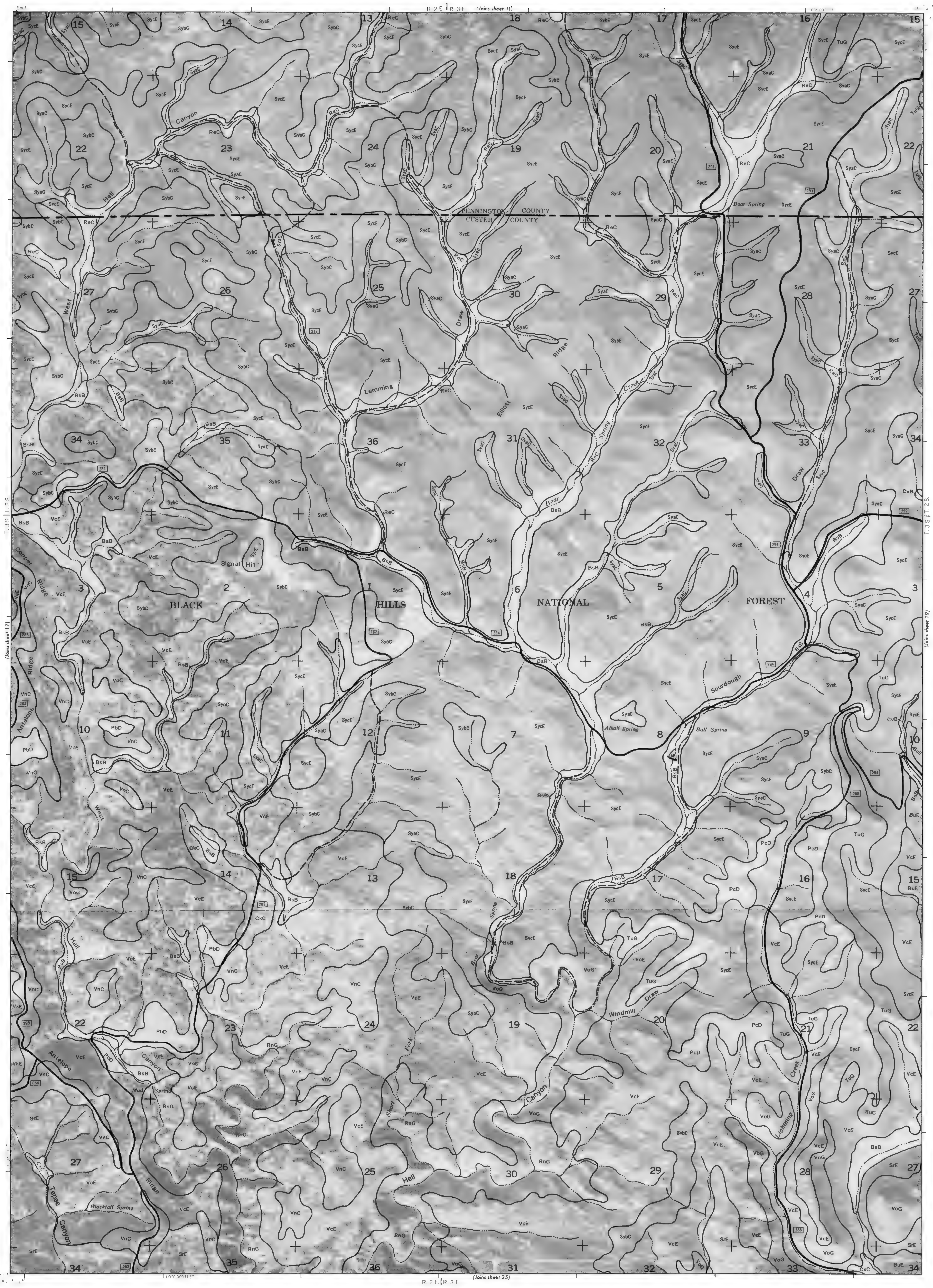
Scale 1:24000

3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 18
CUSTER AND PENNINGTON COUNTIES, SOUTH DAKOTA
BLACK HILLS PARTS



1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

Scale 1:24000

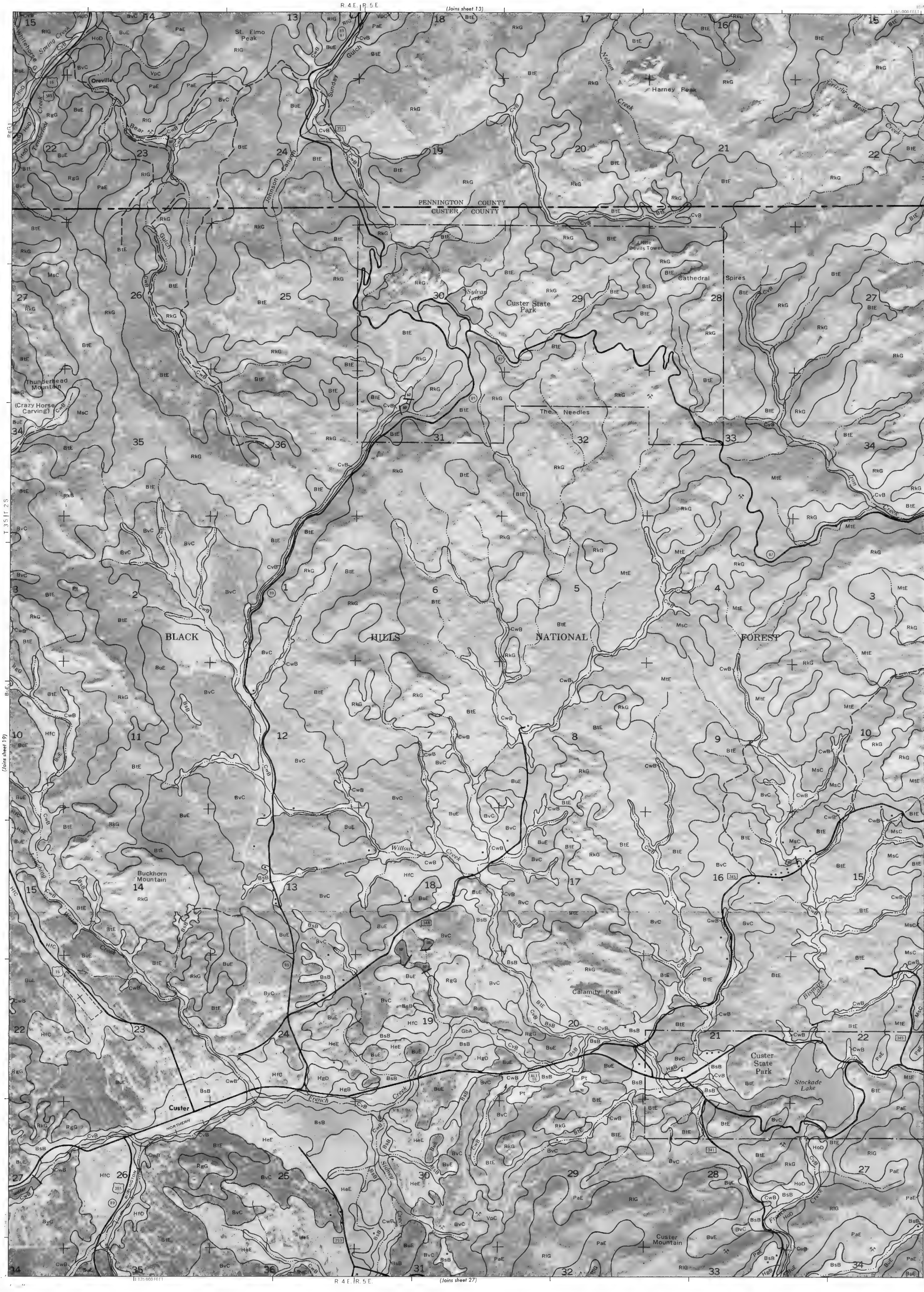
1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 20
CUSTER AND PENNINGTON COUNTIES, SOUTH DAKOTA
BLACK HILLS PARTS



1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

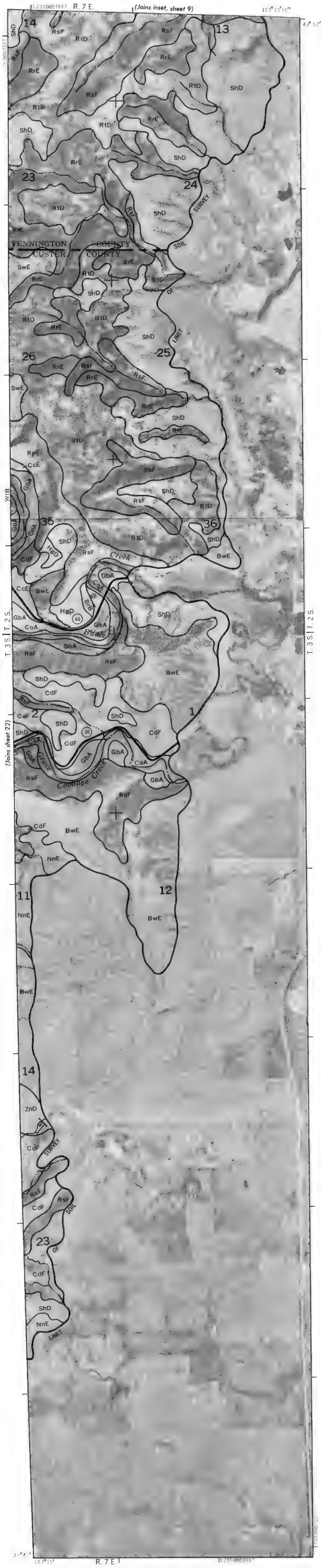
This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 22
CUSTER AND PENNINGTON COUNTIES, SOUTH DAKOTA
BLACK HILLS PARTS

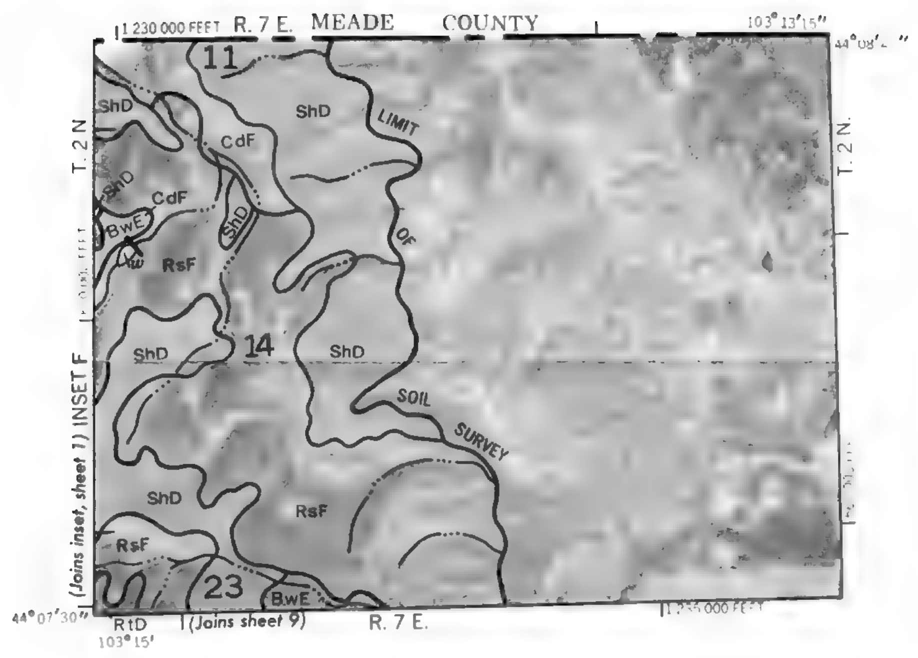
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24 000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.



3000 AND 5000 FOOT GRID TICKS

INSET A



3000 AND 5000 FOOT GRID TICKS

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

Scale 1:24000

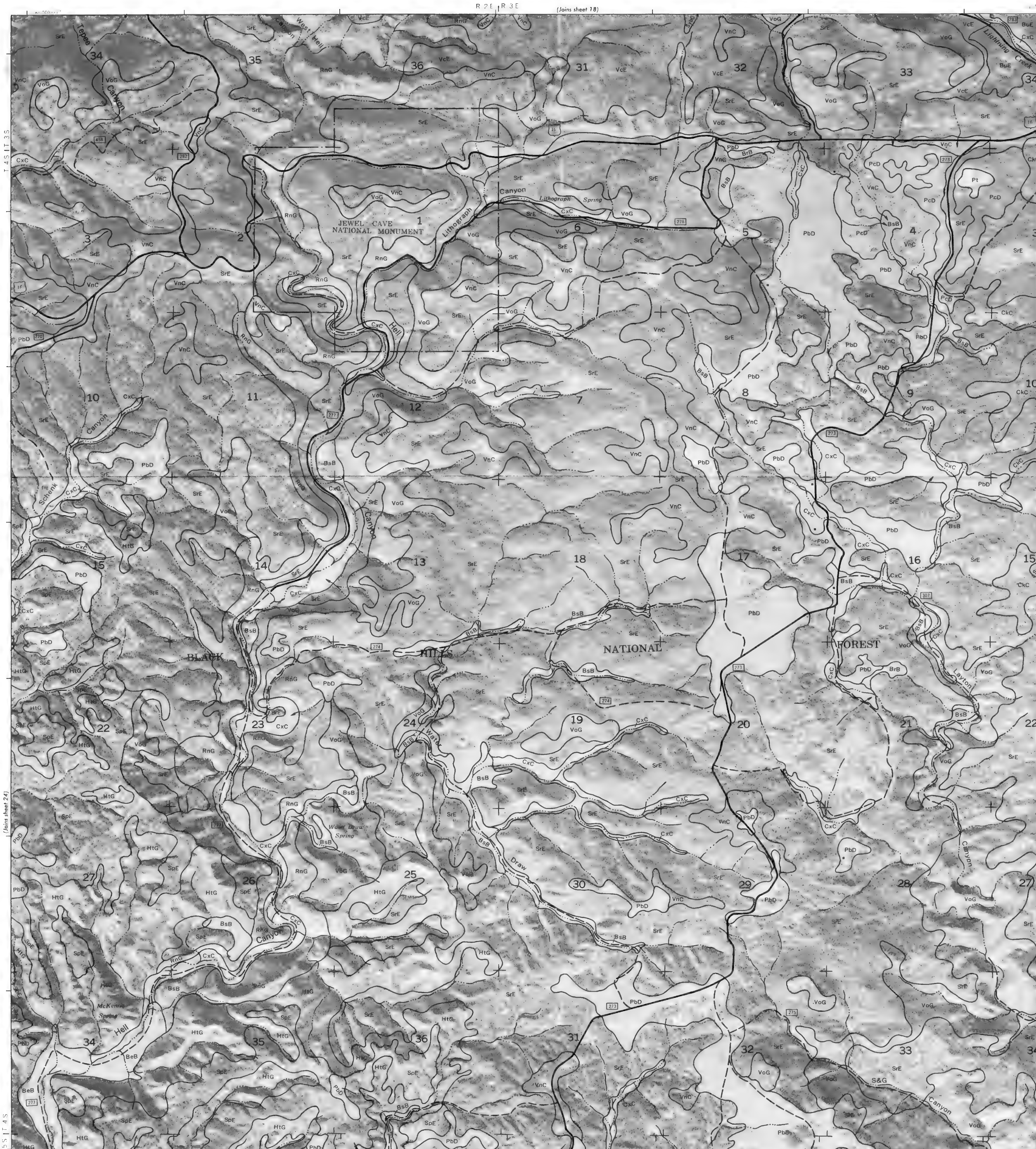
This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 25
CUSTER AND PENNINGTON COUNTIES, SOUTH DAKOTA
BLACK HILLS PARTS



3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

Scale 1:24000

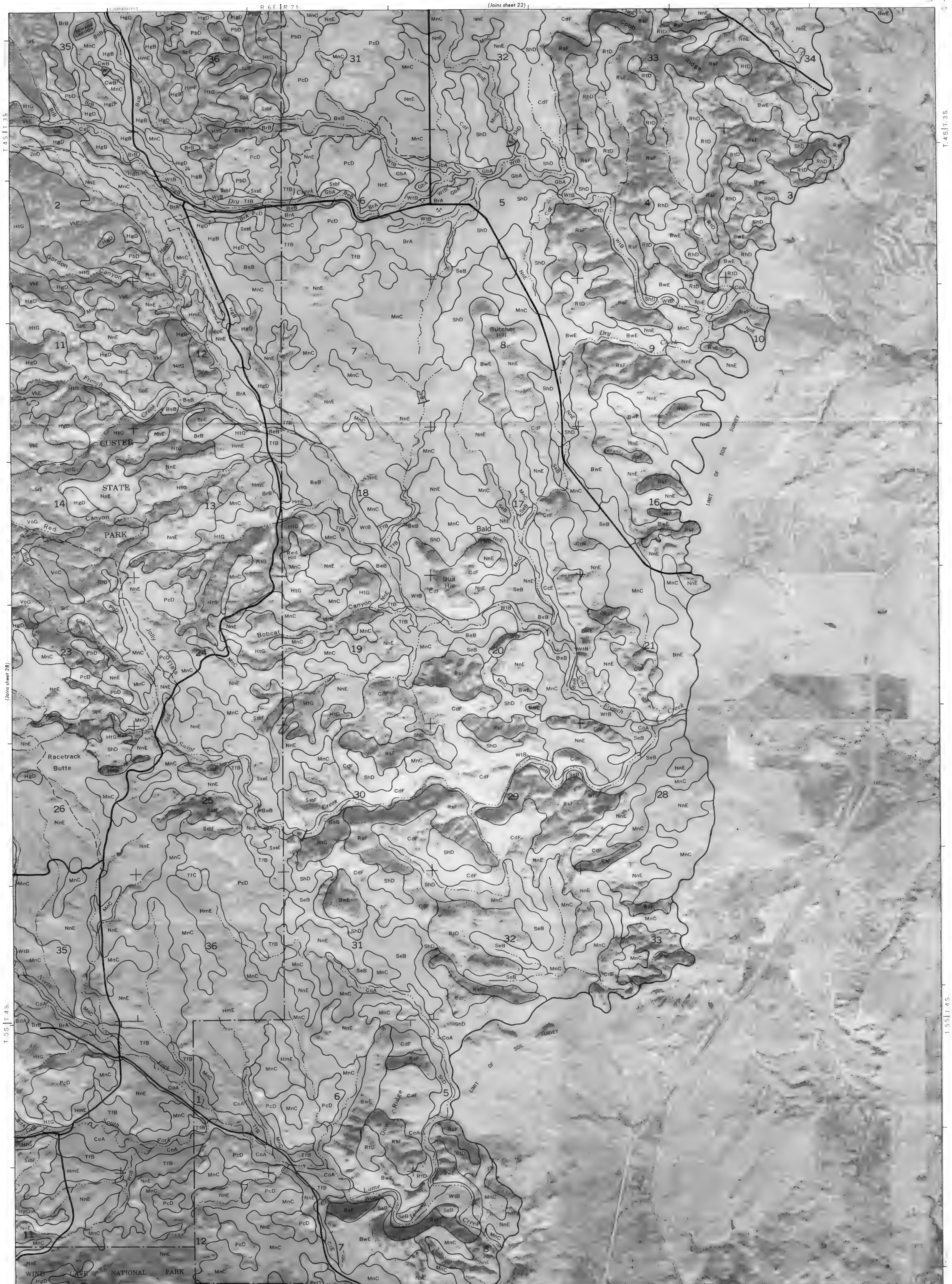
This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

1/4 1/2 3/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

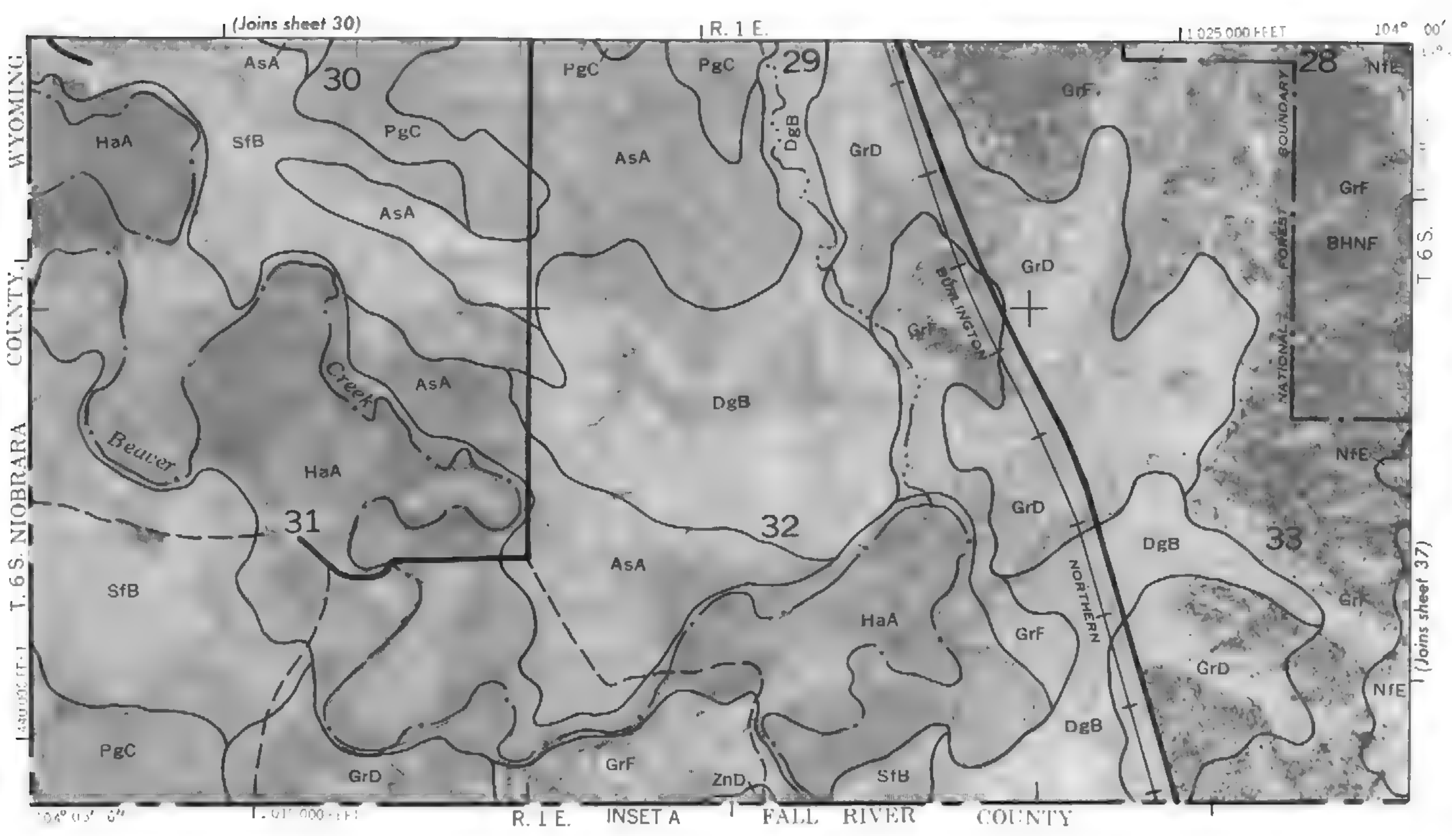
3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

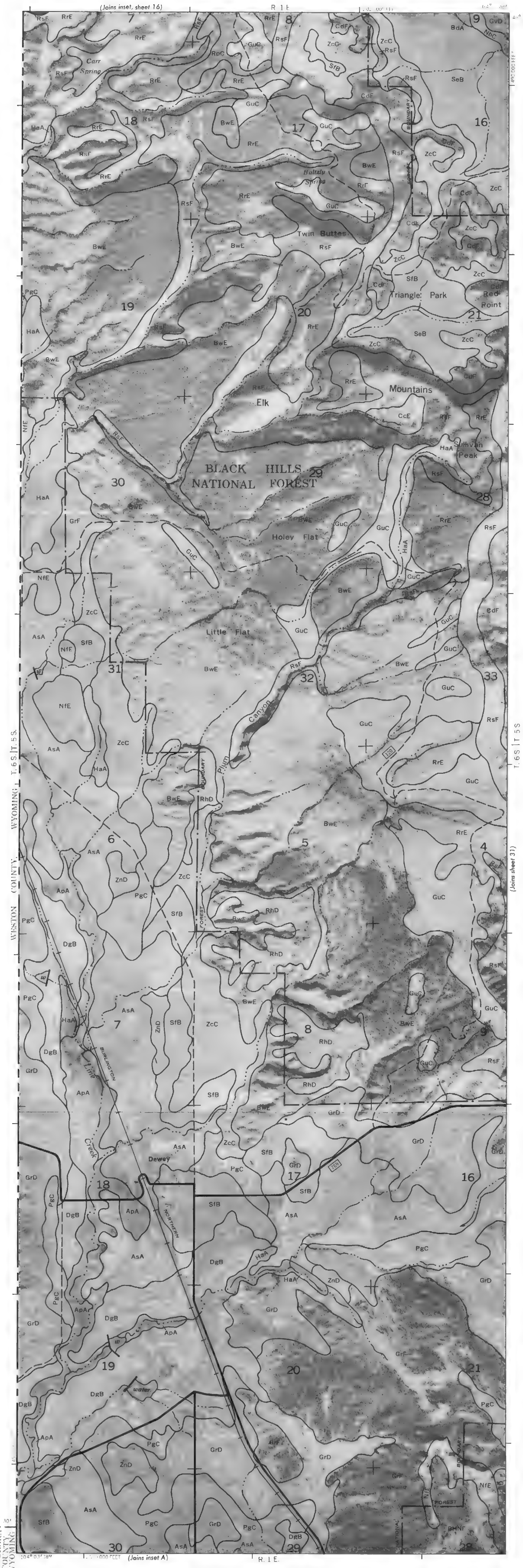
This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

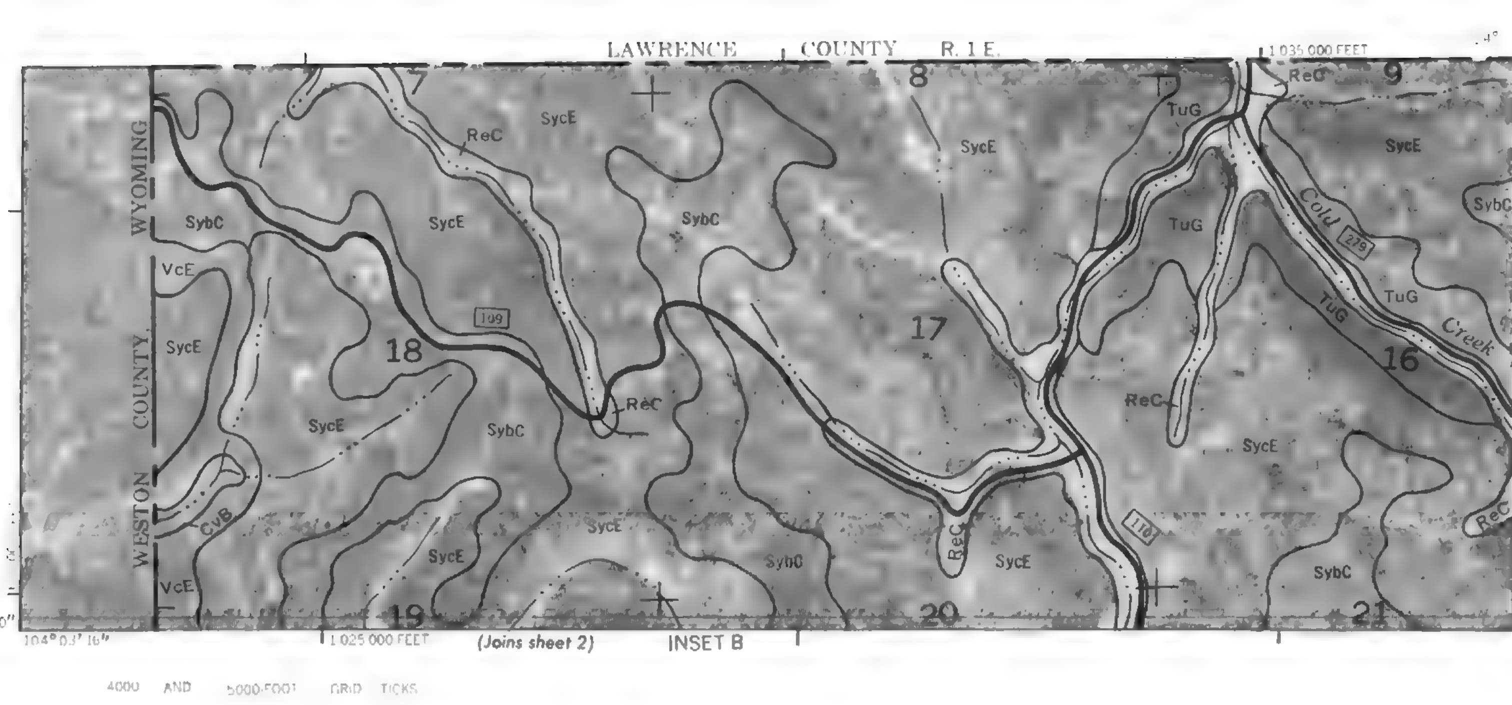


1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.







1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

2 MILES
2 KILOMETERS
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture,
Soil Conservation Service and cooperating agencies on 1975-1982
USGS orthophotography.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

Scale 1:24000

2 MILES

2 KILOMETERS

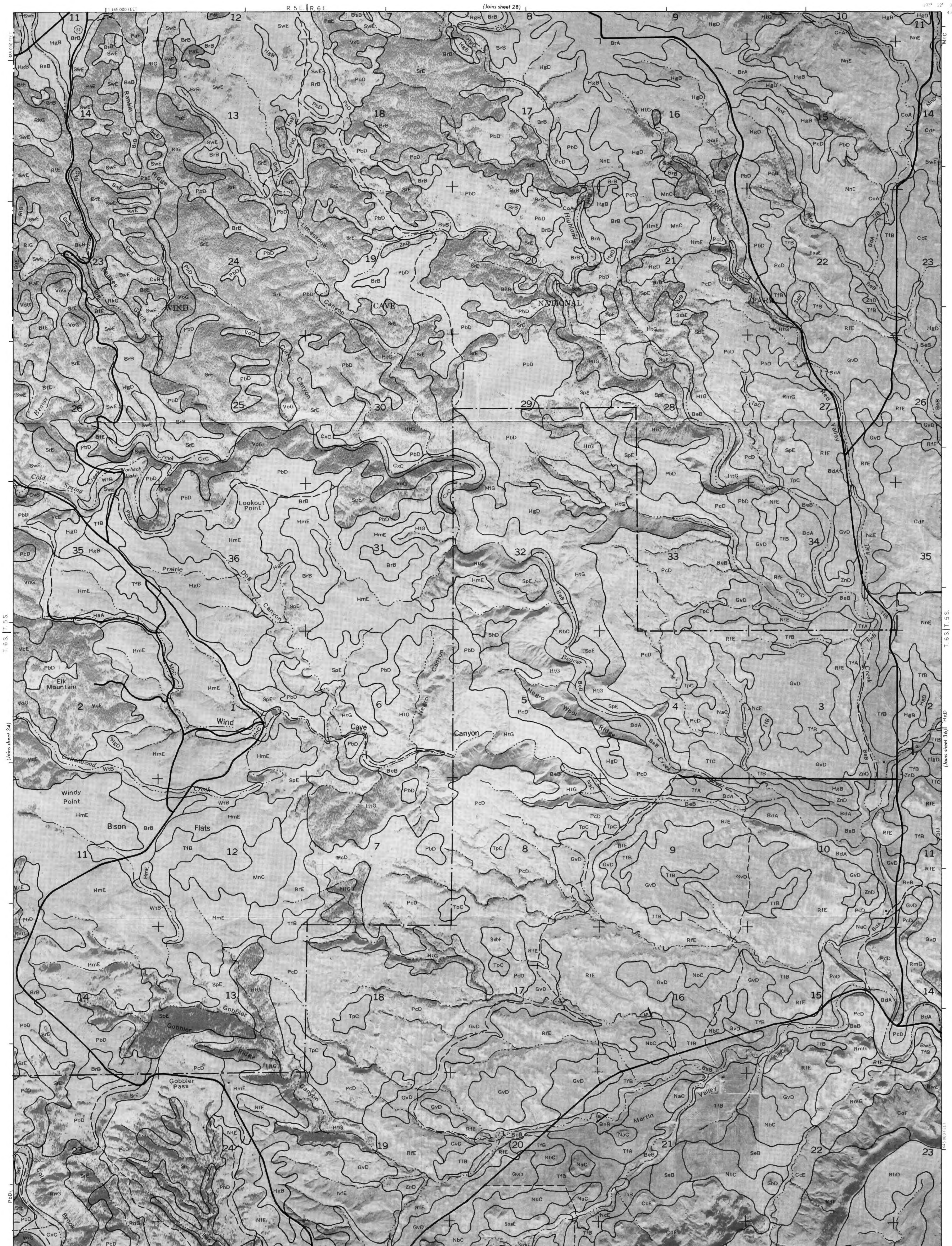
This soil survey was compiled by U.S. Department of Agriculture,
Soil Conservation Service and cooperating agencies on 1975-1982
USGS orthophotography.

Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

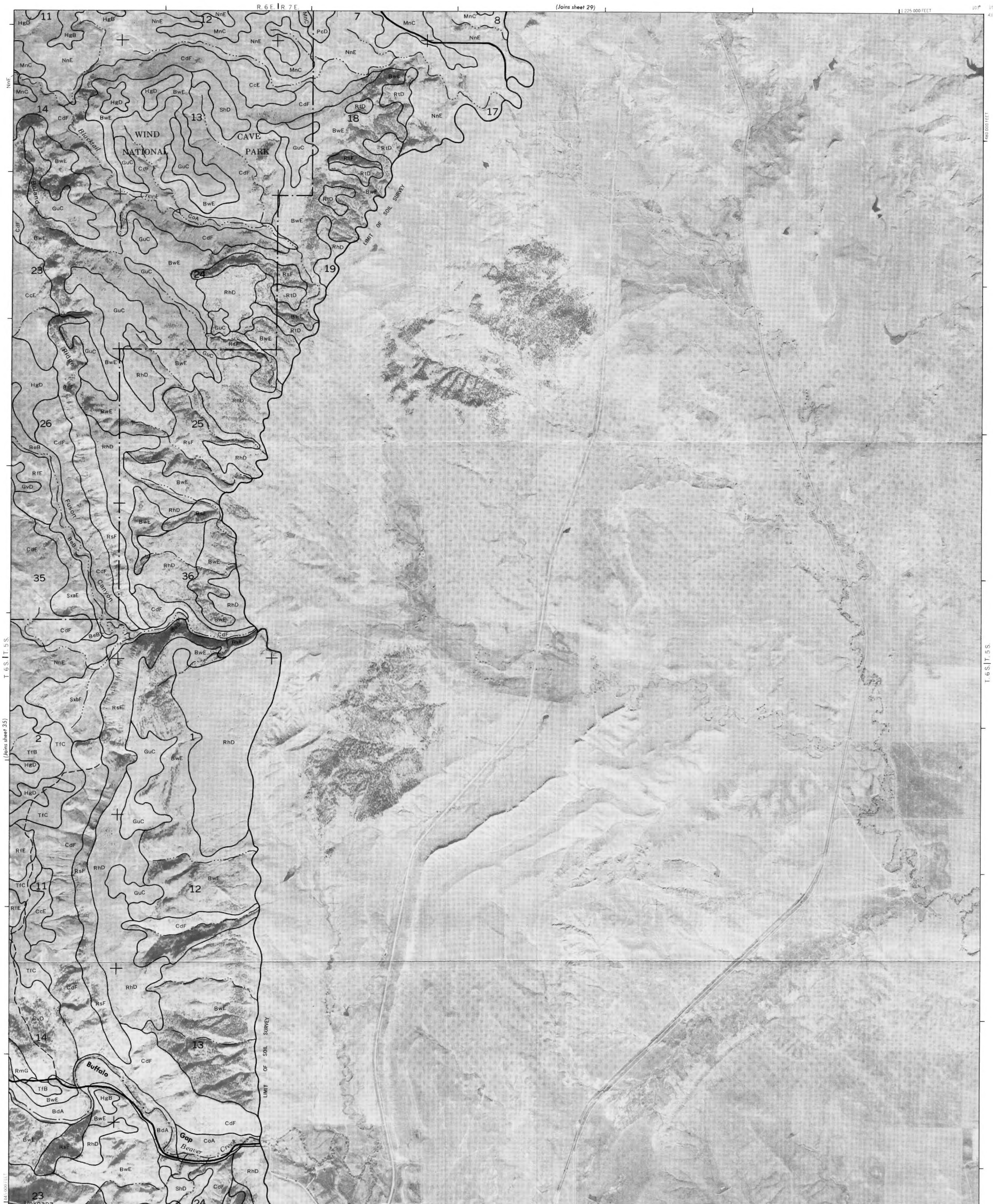
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 35
CUSTER AND PENNINGTON COUNTIES, SOUTH DAKOTA
BLACK HILLS PARTS



Scale 1:24 000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

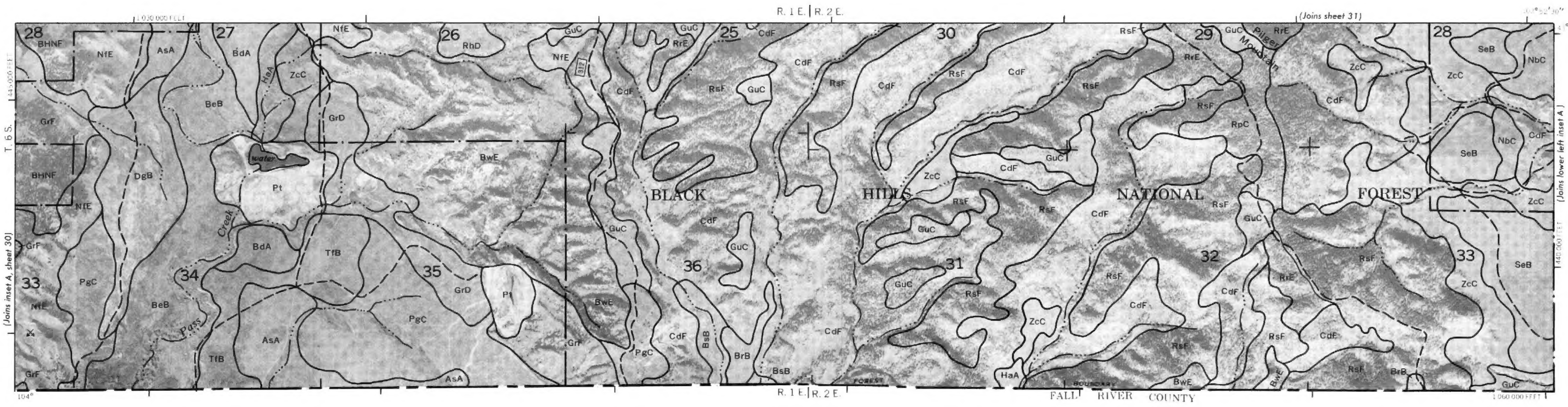


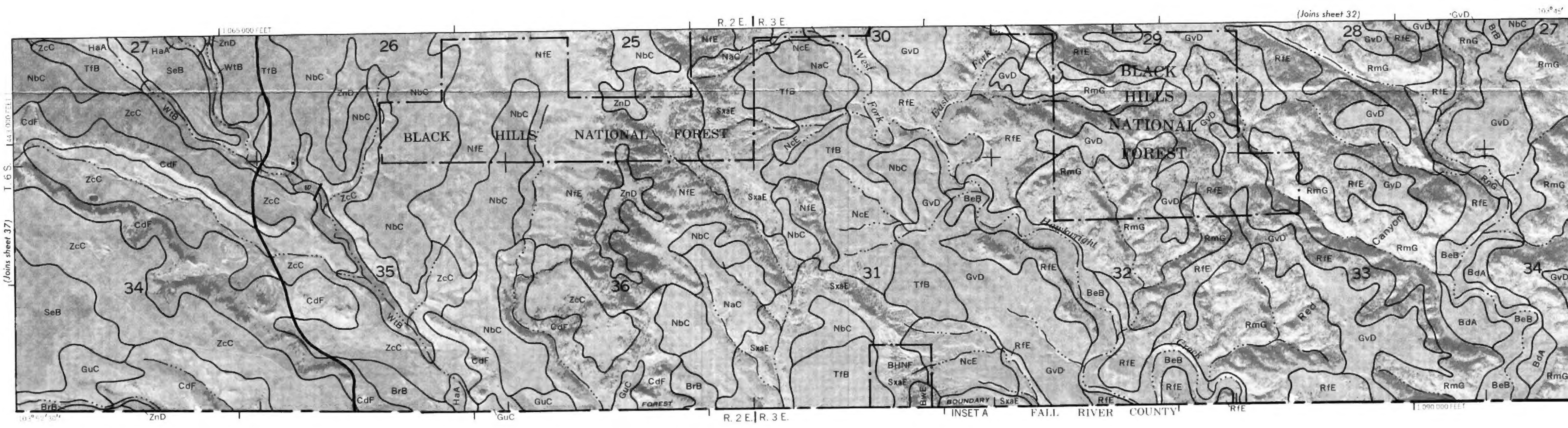
3/4 1/2 1/4 0 1 2 MILES

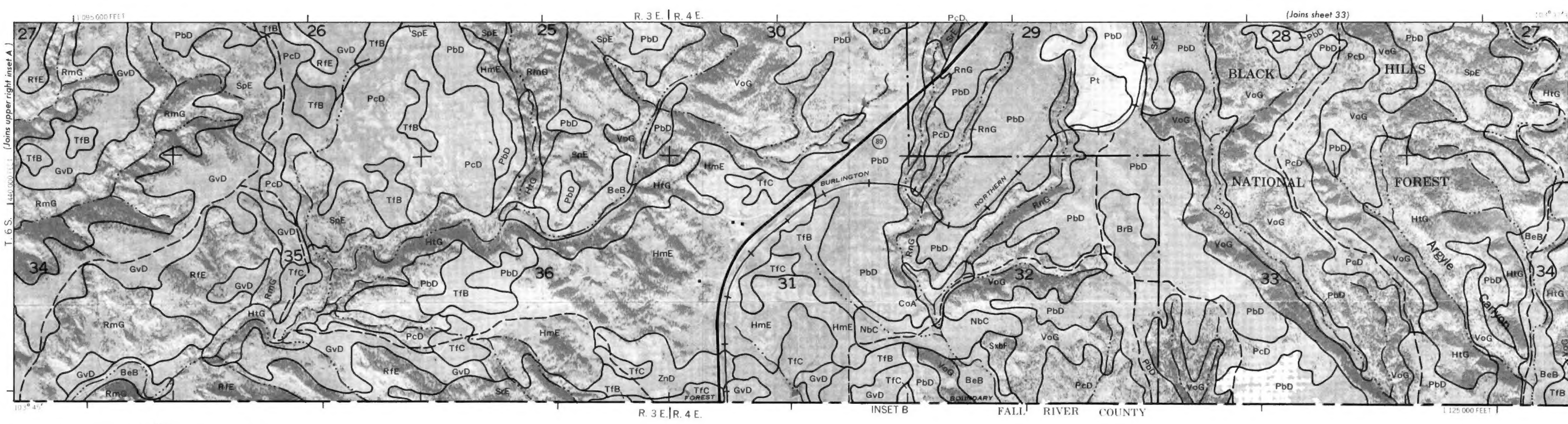
1 0.5 0 1 2 KILOMETERS

Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

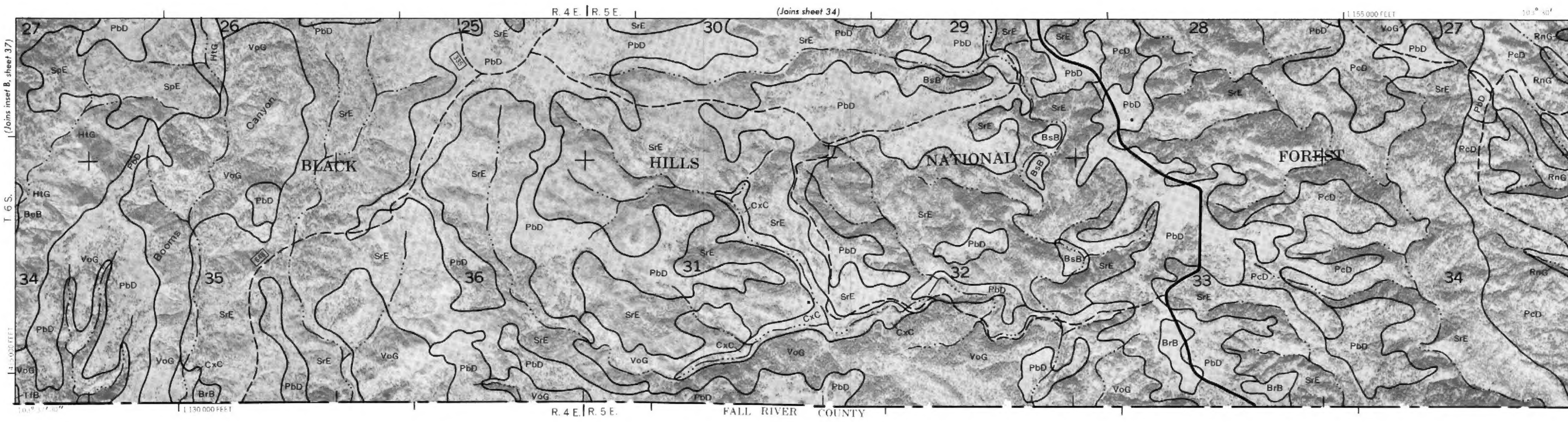


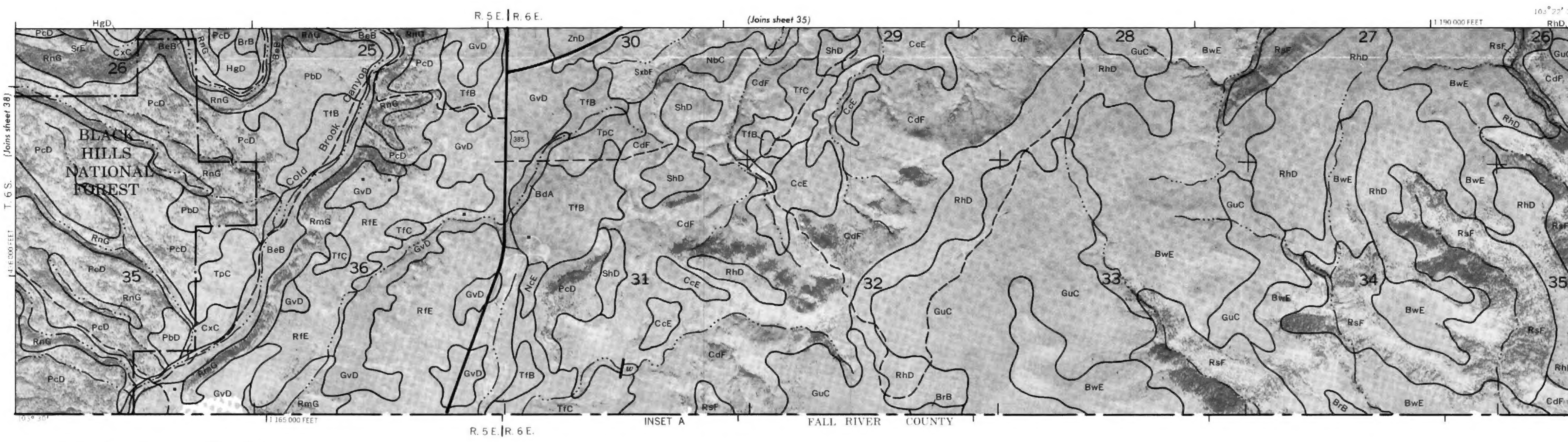




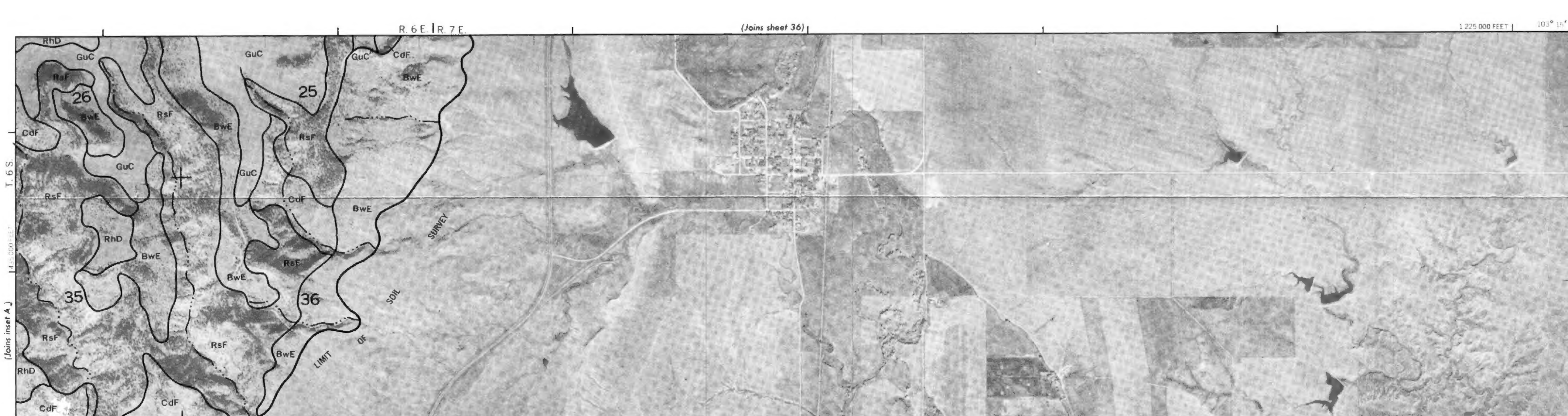
This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE





4000 AND 5000 FOOT GRID TICKS



3000 AND 5000-FOOT GRID TICKS

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

Scale 1:24000

This soil survey was compiled by U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies on 1975-1982 USGS orthophotography.